MODERN APPLIED ARITHMETIC

NEELY AND KILLIUS

DEVELOPED PRIMARILY FOR
CONTINUATION OR PART TIME SCHOOLS

BASED ON THE
UNIT PROJECT METHOD

P. BLAKISTON'S SON & CO.
PHILADELPHIA

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Developed Primarily for Continuation or Part Time Schools

BY

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BASED ON THE

UNIT PROJECT METHOD

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PREFACE

The authors of this book have had several years experience organizing and conducting Continuation schools. During this time they, jointly and separately, have worked out many unit lesons in Arithmetic in an effort to discover just what is necessary to meet the particular conditions in the Part-time School. This book is offered as a solution of the problem for the General Improvement Type of Continuation School.

No attempt is made for logical sequence in developing arithmetical processes and nothing is given for so-called mental discipline. Each lesson is based on some actual life situation which a Continuation School pupil could and often does experience. The pupils are made to feel a practical use of arithmetic through social, personal, commercial, industrial, and scientific applications. Wherever possible *boys and girls are introduced as characters in the* conditions of the problem.

The common practice in arithmetics has been to afford a list of problems, widely different in conditions and interest value, but related in some common process of solution. This Arithmetic for Continuation Schools departs from the traditional form by grouping the entire lesson around a life situation, the conditions of which are

given. As the problems are presented the pupil has an opportunity to exercise judgment in selecting, from the data given, the items and methods that are essential for solution. Wherever possible the lesson culminates in the final, or rather, the original and all important problem, the "why" of the whole matter.

Teachers have found that lessons like these used in this text, solve the problem of interest in the Continuation School. A pupil might object to assignments that savored of grade school days, but when he is introduced to the conditions of a real life problem that some one actually experiences, when his interest is so aroused that he wants to find out the answer for himself, he recognizes that here is *life*, not merely *school*.

This book deals with live boy and girl interests that will evoke comment and afford an opportunity for class discussion and enlargement from a vocational or social angle. No teacher need worry about motivation or incentive. The lessons take care of this by defining purpose, creating enthusiasm, and directing application to immediate life situations in which real persons participate. No boy or girl is so quick to respond to such treatment as the one who is out in the real working world where problems are faced day by day. The wide variety of topics afforded emphasizes the importance of applied arithmetic in life.

Continuation School teachers are confronted with new entrants continuously. Drop-outs are unavoidable, as

pupils reach the upper age limit. Manifestly, all lessons must be on a unit basis, each so complete in itself that pupils attending their first day, as well as pupils attending their last day, will be given something vitally worth while.

These lessons are arranged for any type of Continuation School boy or girl. No effort has been made to grade the work except that the series of questions after each lesson are listed from simple to difficult. Each lesson is sufficiently easy for sixth grade pupils, and sufficiently difficult for ninth grade pupils, to spend their period profitably. The more advanced pupils will merely accomplish more with less assistance.

The teacher can assign each lesson to the whole class as a group, or use the texts for individual assignments, and by selection, pick out those lessons which are of most interest and value to particular pupils. The flexibility of method helps the teacher who has a mixed school, of different grades, different occupations, and different vocational aims.

Although the pupils entering the Continuation School have completed the fundamental processes in arithmetic, and have some knowledge of decimals and fractions, each lesson has been worked out on the basis of reviewing some of these fundamentals. The teacher by following the pupil's efforts, can discover the weakest points in his mathematical ability, and can give him the personal help needed.

No further *suggestions to teachers* are deemed necessary, since the authors have attempted to weave into the very content of the arithmetic the *Spirit of real Continuation School work.* It is hoped that this little book will help give the "vital life value" to all the subjects presented in the "last chance school."

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I

PRICE MARKING

During a rush period one Wednesday morning Anna's employer asked her to help mark prices on a shipment of goods. Her instructions were to add 35% to the costs as marked on the shipping bills. From these bills she secured the following information—

Raisins—1 case—45 pkgs. to case	**$9.45**
Currants—1 case—24 pkgs. to case	**6.72**
Shelled Walnuts—1 case—24 cans to case	**13.44**
Salmon—2 cases—48 cans to case	**25.92**
Lima Beans—3 cases—24 cans to case	**16.56**
Peas—2 cases—24 cans to case	**14.88**

QUESTIONS

1. What was the total amount of the order?
2. Find the cost of each article per package or can.
3. Adding the 35%, find the selling price of each package or can.
4. The employer, through experience, has discovered that the 35% increase is divided about this way—

   4% freight charges and losses
   15% clerk hire
   6% "overhead"—rent, stationery, insurance, etc.
   10% profit

   What were the amounts assigned to these items in this shipment of goods?

II

CAMPING CLUB

Although we all enjoy the comforts and pleasures of our own homes, we are always ready to spend some time each summer in a camp. There, it doesn't matter whether the roof leaks or not, it doesn't matter if the fish is burnt or not, everything that happens seems to be fun. The camping trip each year has become so popular, that many boys and girls have formed camping clubs. Initiation fees and dues are paid, ground and tents are purchased or rented. In order to give each a chance to enjoy the camp, it is kept open for several weeks. One camping club's accounts were as follows—

Number of members, 60. Monthly dues paid for six months—January to July—$1.50 per member. Initiation fee $2.50.

The dues and initiation fee entitled each member to stay at the camp for one week. For each additional week, an extra fee of five dollars was charged. The camp was kept open for six weeks.

12 members stayed three weeks each.
18 members stayed two weeks each.
30 members stayed one week each.

Expenses

Rental of ground, tents, and equipment—$30.00 per week.
Meals cost 33¢ each.
Each member received 21 meals per week.

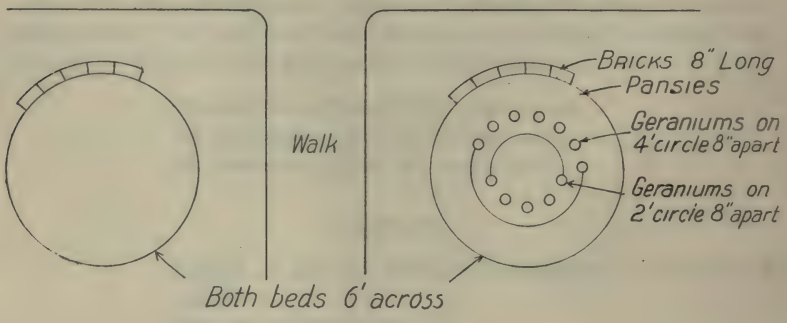
QUESTIONS

1. What was the amount of money received from initiation fees?
2. What was the amount of money received from dues?
3. What was the amount of extra money received from ones staying more than one week?
4. What were the total receipts?
5. Find the number of meals served and cost at 33¢ each.
6. Find the total expenses. Balance in the treasury.
7. What was the cost per week for a three weeks person? For a two weeks person? For a one week person?
8. Make a schedule showing the number of each kind—three week people—two week people—one week people—in the camp each week. The camp had quarters for only 17 at a time.

III

FLOWER GARDEN

When Springtime came, Mother commenced to get anxious about the garden. She told Anna, that she and John were to plan two flower beds for the front lawn, one on each side of the walk. The two children decided to mark out two circular plots, each about 6′ across. They planned to plant two circles of geraniums, with a border of pansies. Around the edge of the plots, they were going to set bricks. The ground being rather poor, they found that they would need enough earth to make a 6″ depth on each plot. Their idea is shown by the sketch.



QUESTIONS

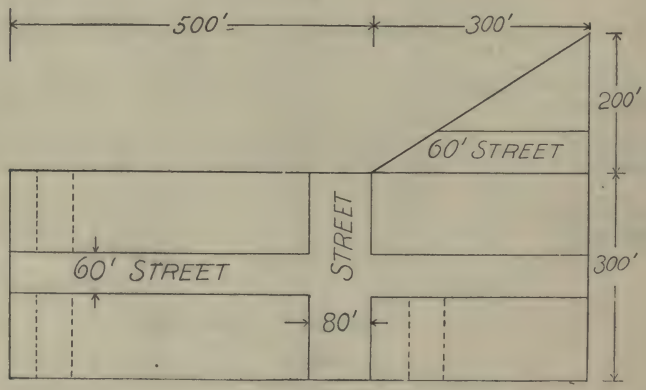
1. In laying out the plots, they placed a stake with a string attached to it. They then marked out a circle, using what length string for a circle 6′ across?
2. What was the distance around the outside of the 6′ circle? How many bricks 8″ long did it take for the two plots?
3. What was the distance around the 4′ circle of geraniums? Around the 2′?
4. How many geraniums did it take for both plots?
5. The earth was sold at $0.50 a cubic yard. About what did earth cost for the two plots?

IV

BUILDING LOTS

How did Mr. Brown make all of his money? Mr. Brown makes no secret of his method. When the city was young, he studied its growth very carefully. He learned that the population was increasing steadily each year. He noticed that the residential district was growing in a northernly direction. Having faith in his knowledge, he purchased portions of farms on the northern outskirts of the city. After purchasing each new plot, he laid it out in building lots and patiently waited for the city to grow till it reached his holdings.

One of these plots was of the size and shape of the following sketch—



QUESTIONS

1. Find the number of square feet in the plot?
2. There are 43560 square feet in one acre. Was Mr. Brown cheated when the plot was sold to him as containing 6 acres?
3. He paid $160 per acre for the plot—6 acres—what was cost?
4. The surveyor laid the streets as shown on the sketch. Then the land in the rectangular section was laid out in lots, each with a 60′ frontage. What was size-frontage and depth-of each lot? How many lots were contained in the plot?
5. These lots were sold at $8.00 per front foot. What was the amount received for them?
6. The upper triangular plot was sold for $800.00. What was the total amount received for the entire plot?
7. Surveying, improving, taxes, advertising costs amounted to $1800.00. What was Mr. Brown's profit?
8. Supposing two cross streets had been required, show by sketch your arrangement of the plot. Give number and size of lots by your plan.

V

"HOT DOGS"

When we enter the fair grounds, about the first thing that we hear is "Get 'em while they're hot." One of the most profitable stands at the fair is the small "doggie" or "Hot-dog" stand. The money necessary to start such a stand is small in amount, the danger of losing is not large if the business is operated in a careful manner. And there is a lot of fun mixed in with the hard work.

At the end of a fair week the owner of a stand of this kind had the following list of expenses and receipts. Let us see whether the business paid or not.

Expenses

Lease of a ten foot plot of ground	$ 5.00 per foot
Lease of a tent	8.00
Lumber and hauling	12.00
Cooking equipment	25.00
Charcoal for stove	5.00
Glasses	1.50
"Doggies" 17 to the pound	.40 per lb.
Rolls	.15 per doz.
Lemons	.20 per doz.
Sugar	.10 per lb.
3 helpers	2.50 per day

Receipts.

Each person averages one sandwich for ten cents, and one glass of lemonade for five cents.

The following numbers of persons were served—Sunday 500, Monday 500, Tuesday 400, Wednesday 800, Thursday 1200, Friday 900, Saturday 800.

One dozen lemons and two pounds of sugar are allowed for 25 glasses of lemonade; one roll and one "doggie" to a sandwich.

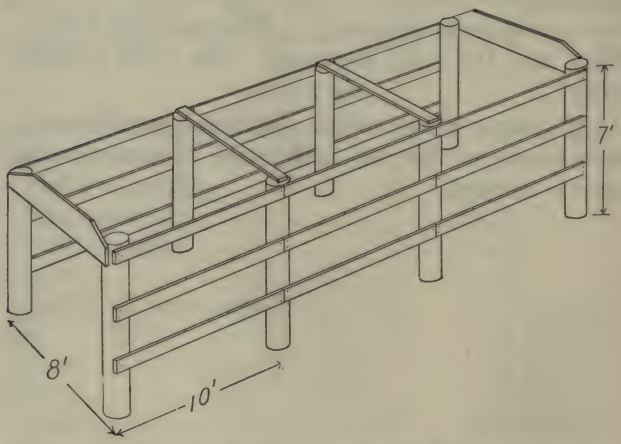
QUESTIONS

1. How many sandwiches were sold? How much money was received for them?
2. How many glasses of lemonade were sold? How much money was received for them?
3. What was the total amount of money received?
4. How many "doggies" were sold? How many pounds? What was the cost?
5. How many rolls were sold? How many doz.? What was the cost?
6. How many lemons were used? How many doz.? What was the cost?
7. How much sugar was used? What was the cost?
8. What was the total expense? The total receipts? The profit?
9. Do you know of any article that has been omitted? Make an estimate of its cost and make this correction in the amount of profit.

VI

GRAPE ARBOR

The large back yard of Mr. Holmes was bare, save for a few fruit trees and a small garden. Mrs. Holmes had been wanting a grape arbor for years, not only for the fruit but also for the shade. This spring Mr. Holmes and his son John were making plans for the style, location, and cost of the grape arbor. Their sketch of the arbor was something like this—



Posts were 7 feet above ground, 30 inches below ground,
All strips except two end pieces were ½ inch thick, 2 inches wide.

QUESTIONS

1. How many posts were needed? What was the length of each post?
2. How many strips were required for sides? For the top? For the ends?
3. Make an estimate of the total cost by using the following schedule.

Name	Material	Size	Number	Cost	Total cost
Posts	Chestnut			$1.15 a piece	
Side Strips	Cypress			4¢ a foot	
Cross Strips	Cypress			4¢ a foot	
End Strips	Cypress	½″ by 6″ by 8′		$1.25 a piece	
Vines	one for each post @ $4.00 a dozen				

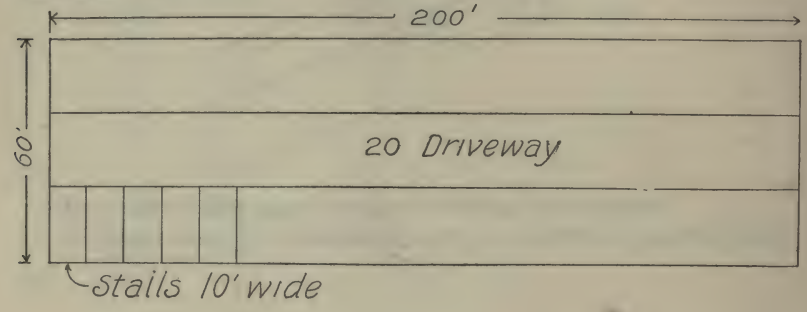
4. What materials have been omitted in the list? What would be your estimate of the cost of these?
5. A contractor offered to put up the arbor for $35.00 Was this a reasonable price? How much did Mr. Holmes save by doing the work with the help of John?
6. What would be your estimate of the time required for two men to erect the arbor and the cost of their labor at 43¢ per hour? Adding this amount to the material, what profit would the contractor have made?

VII

PARKING PLACE FOR AUTOS

"Going down town?—jump in." As Herman was waiting for the street car one morning, an auto stopped in front of him, and the driver gave him this invitation. He accepted gladly. Everything went well until they arrived in the business section. No place to park the car could be found. Finally they did succeed in finding a place four blocks away from the office. During the day, Herman kept thinking of his morning's experience. When he returned home in the evening, he spoke of it to his sister. He said "Do you know if a fellow rented that vacant lot at the corner of Main and Sixth, he could make a lot of money by turning it into a parking place." Of course, Anna laughed at his idea, as usual. But Herman was so interested in the idea that he and his sister worked on these calculations. Let us see if the idea was a good one.

The lot measured 60 ft. front by 200 ft. deep. They drew a sketch like this—



They decided that they would need a driveway 20′ wide, so that cars could back out of the stalls. Car measurements were found to be approximately 15′ by 8′.

QUESTIONS

1. What were the measurements of each stall?
2. How many stalls were there by this arrangement?
3. Suppose the lot was filled two times per day by cars parking about two hours each, what would be the day's receipts, if the parking charge was 10¢ per hour, per car?
4. The expenses were—$150.00 rent per month, $125.00 per month for attendant (gave out car checks and watched cars) $25.00 per month for miscellaneous expenses. What were profits per month? Use 30 days per month.
5. Can you work out a better arrangement for the stalls, so that more cars could be accommodated? Do not use a smaller size stall.

VIII

FALLING BODIES

All the people in the Carnival Grounds were closely watching "Daro the Diver" making preparations for the nightly high dive from the top of the 150′ ladder to the small tank below. Several men were discussing the actual distance of the diving platform from the ground. One of the men was saying, "well that is not 150′ high." His companion said, "I believe it is only 100′, let us measure it." The question came up "How?" "Very simple" said the companion, "I happen to have a split-second stop-watch in my pocket. You give me a nudge when the man dives and when he hits the water, and I'll do the rest." The time was taken and found to be 2.8 seconds. The companion said the distance is about 125 feet.

And this is how he did it.

In a study called physics, we find a short rule (formula) which tells us that the distance in feet that a body falls can be found by multiplying 16.08 by the time in seconds squared thus:

d equals 16.08 times t^2

d equals distance in feet
t equals time in seconds
t^2 equals t times t.

The time in our problem was 2.8 seconds, then—

$$d = 16.08 \times 2.8 \times 2.8 = 126.06'+$$

QUESTIONS

1. If the time had been 2.9 seconds, what would have been the approximate height?
2. From the top of the "high rocks," John dropped a stone to the lake below. He counted 4, Mary counted 5, and Jennie was just about to say 5, when the stone splashed into the water. About how high were they above the lake?
3. Make a table showing the distance that a body would fall in 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, seconds.
4. This rule does not make any allowance for the resistance that the air offers to a moving body. An aviator in jumping from an aeroplane with a parachute, takes 30.5 seconds to reach the earth. What distance would our formula give us? Would this be greater or less than the true distance? Why?

IX

MAKING CHANGE

No matter what kind of work you do, or whether you do no work, it is very important that you be able to count change quickly and accurately. You have all noticed some women or men stand and count the change handed to them by the street car conductor, over and over again. This lesson is given for the purpose of drill in making actual change calculations.

About the best method of making change is to add to the amount of the purchase, the smallest coins or bills first and then the larger ones, until the amount of the offered money is reached.

Example.—A two dollar bill is offered for a seventeen cent purchase. The change—three cents, five cents, a quarter, a half dollar, a one dollar bill.

QUESTIONS

1. One dollar bills are offered in payment of the following amounts 15¢, 18¢, 11¢, 24¢, 35¢, 49¢, 61¢, 64¢, 86¢. Give change for each.
2. Select proper change for a customer who offers $2.00 for this purchase—One pound of pork chops at 35¢ and two pounds of bacon at 40¢ a pound.
3. Give the change as a ticket seller would count it to a person who offers a twenty dollar bill for two 33¢ tickets.
4. A cashier in a bank is given a check for $96.00. What bills would he offer in cashing it?

5. A railroad ticket costs \$2.19. What is proper change from a five dollar bill?

Make a table of the following amounts:

1¢ 5¢ 10¢ 25¢ 50¢ \$1.00 \$2.00 \$5.00 \$10.00

Fill out the proper amounts of change for each of the following cases:

Purchase	Money Presented
\$ 2.18	\$20.00
3.96	5.00
4.65	10.00
2.35	3.00
7.24	10.00
13.53	20.00

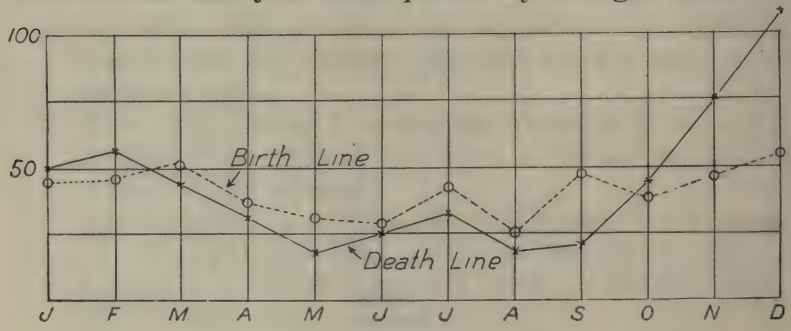
X

CHART MAKING

Formerly when reports were made by doctors, engineers, or others, they would write out long columns of figures that were very uninteresting. Nowdays they make pictures of these figures and everyone can see what has happened. For example a city keeping a record of births and deaths had sets of figures like these for the twelve months:

Births: 44–48–50–40–35–30–44–25–50–35–48–56
Deaths: 50–54–40–35–20–28–36–18–20–40–80–120

If we just read the figures we can't understand or see just how the two changed from month to month. But suppose we draw twelve vertical lines one for each month, one-half inch apart. We shall say that every inch height of these lines equals 50 births or deaths. Then we shall measure the proper heights for each month and join these points by straight lines.



Now you can easily see that the highest birth rate was in December; the lowest in August. You can see that the deaths were greater than births in January and February, then dropped below the birth rate until October. At October the death rate increased very fast. Probably some serious epidemic occurred in the city.

QUESTIONS

1. Make a chart of the attendance of Harry's Sunday school letting one inch equal 40. The following numbers give the average attendance for the Sundays of one month, starting with January: **35–30–30–45–10–45–20–15–25–35–45–50.** Why do you suppose attendance dropped to 10 in May and jumped to 50 in December?
2. Harry's father asked him to make a chart of his (father's) income and expenses for one year.

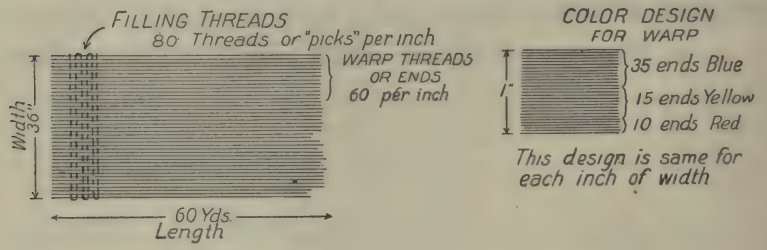
The monthly income was $175.00. The expenses each month were $125.00, $137.50, $112.50, $150.00, $100.00, $175.00, $100.00, $125.00, $175.00 $162.50, $125.00, $175.00.

Use your own scale if possible. If you cannot think of one, use one inch equals $100.00.

XI

WEAVING

When the class visited the cloth mill, to see how cloth was woven, many were surprised to learn that the total length of thread required for a piece of cloth 10 yds. in length, might be as much as 10 miles. As we all know, common cloth consists of threads (ends) running the length of the piece (warp), and threads running across the width (filling). The calculations required in finding the cost of cloth, are complicated. The following problems will give some idea of the calculations used in finding the amount of thread for a certain length or "cut."


FILLING THREADS
80 Threads or "picks" per inch
WARP THREADS OR ENDS 60 per inch
Width 36"
60 Yds. Length
COLOR DESIGN FOR WARP
35 ends Blue
15 ends Yellow
10 ends Red
This design is same for each inch of width

In this piece of cloth we have a length of 60 yds. The cloth is 36" wide. In the warp we have 60 threads per inch. In the filling, 80 threads per inch.

QUESTIONS

1. How many yards long is each thread (end) of the warp? How many threads of warp do we have in the 36″ width? How many yards of material for the warp?
2. How many yards long is each thread—(end)—of the filling? How many threads per inch in the filling? How many threads of filling in the length 60 yds.? How many yards of material is required for the filling?
3. What is total number of yards?
4. The filling threads are all black. The warp threads are arranged according to the color design in the sketch. How many yards of each color are required?
5. An allowance for shrinkage and waste is made. If this allowance were to be 10%, what would be your order for the different colors?

XII

A BUS-LINE

In many places where the street car service is poor, or its price too high or where there is no good train service, the auto-bus or "jitney" business has been very profitable. This business requires quite a large capital, and is rather dangerous, so that a number of men usually form a company when they enter it. Before going into the business, a careful study is made of the possible number of people to be carried and the estimated expenses are made large enough to take care of accidents. If the outlook is good, it is usually easy to secure the money necessary for starting.

Among the expenses and receipts of such a business, the following items are most important:

Expenses.

Equipment—2 Auto Busses	$2000.00 each.
1 set spare tires	60.00 per tire.
Tools and small equipment	150.00
4 Drivers	70¢ per hour.

Each driver works 8 hours per day except on Saturday and Sunday, when he works 9 hours.

Oil, each bus uses 1 gallon of oil per day @ 60¢ per gal.

Gasoline, each car uses 6 gallons gasoline per round trip @ 28¢ gal.

Repairs and accessories	$ 90.00 per month.
Rent for garage	$ 20.00 per month.
Licenses	$100.00 per year.
Advertising	$150.00 per year.

One new set of tires for each car every three months @ $240.00 per set.

Conditions.

Each car makes 16 trips or 8 round trips daily except Saturday and Sunday; then 18 trips or 9 round trips.

Average number of passengers per car per trip daily = 7

Average number of passengers Saturday and Sunday = 10

The cars run 52 Sundays and 52 Saturdays each year.

Charge for passengers 40¢ per trip.

QUESTIONS

1. How many single trips does each car make per year? Both cars? Round trips?
2. What does the gasoline cost per year for both cars?
3. What does the oil cost for both cars per year?
4. What do the tires cost per year for both cars?
5. How many passengers are carried by each car daily? Saturdays and Sundays? How many passengers in all? How much money is received from the passengers per year?
6. How much money is paid to the drivers per year?
7. Find the total expenses for the year. Add 10% for unforeseen or extra expense.
8. Find the profits.

XIII

A WINDOW CLEANING BUSINESS

In nearly every town or city, we find one or more people or companies engaged in what is called a window cleaning business. It is only one of many forms of business that have been started by alert, ambitious persons who have discovered the need for some new kind of service. It usually pays well and there is always work to be done.

If we would examine the books of a company of this kind, we might discover that expenses and receipts were about like the following:

Expenses.

Telephone	$ 2.50 per month.
Advertising—cards, newspapers, etc	$ 35.00 per month.
Equipment—buckets, ladders, brushes, cloths, chamois, etc	$250.00
Washing compound	.50 per day.
Stationery—books, letter paper, bills, receipt blanks	$ 8.00 per month.

Labor—Three men @ 70¢ per hour, 8 hours per day.

The manager of the business spends his time in soliciting orders, keeping books, collecting money, sending men to proper places. Since the business is small, no regular office is necessary at first. A small outbuilding is used as a storage place.

The receipts are as follows.

A charge of 10¢ is made for each window. Each man averages ten windows per hour.

The working days are:

Jan. 21½	**April 24**	**July 20½**	**Oct. 23**
Feb. 22	**May 23**	**Aug. 16**	**Nov. 22½**
March 24	**June 21**	**Sept. 20½**	**Dec. 19**

QUESTIONS

1. Find the number of hours worked by each man per year, find amount paid to men.
2. Find the total hours worked by the three men, the number of windows washed by them.
3. Find the money received by the manager at 10¢ per window.
4. Find the amount of all expenses per year.
5. What are the profits?
6. Suppose that you owned this business, what would you consider a fair price for it? Give your reasons.

XIV

COLORADO OIL SHALE

All of us know something about the importance of the automobile industry in our country. We can easily imagine what would happen to many business companies if our supply of gasoline was cut off. Our government, realizing that the oil wells (from which we get our gasoline, after the oil goes through certain refining processes) cannot last forever, has made investigations to find what could be done if the oil wells give out. It has discovered that there is a great quantity of "oil shale" in several of our states, from which oil can be secured.

One tract of land in Colorado contains 2500 sq. miles of this shale. The average thickness of the shale bed is 10 feet. About 60% or three fifths of this amount can be used. The shale must be crushed, pressed and the product refined.

18 cu. ft. of this shale make one ton.

It takes about one ton of shale to make one barrrel of oil. The costs per ton of shale are:

Ins., taxes, repair, equipment, etc	$0.32
Labor	.50
Quarrying the shale	.45
Extracting ammonia	.10
Refining	.60
Transportation	.50

Receipts per ton of shale are:

Gasoline	**8.9 gallons**	**@**	**.20 per gal.**
Paraffin	**23 pounds**	**@**	**.06 per pound**
Ammonia sulphate	**17.2 pounds**	**@**	**.05 per pound.**
Lubricating oils	**17.65 gal.**	**@**	**.50 per gal.**

QUESTIONS

1. Find the number of cubic ft. of shale per square mile.
2. Find the number of tons of shale in this many cubic ft.
3. Find the total cost of preparing one ton of the shale.
4. Find the total receipts from one ton of shale.
5. Find the profit per ton of shale.
6. Find the total profit from one sq. mile. From 2500 sq. miles.

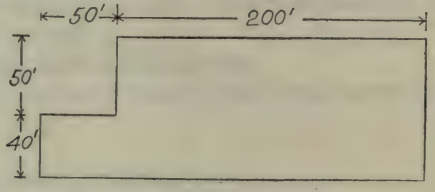
XV

HARVESTING ICE

In these days, most of our ice comes from the large ice manufacturing plants. There are, however, many ice ponds scattered throughout our country, upon which the smaller communities depend for their supply.

One of these ponds was owned by a farmer, who found that his ice crop was as valuable as the grain crop of his farm. His pond was of the size and shape shown by the sketch.

During one winter he harvested three crops, the first 5″ thick; the second 8″ thick; the third 6″ thick. Each time he had blocks cut 1′ by 2′, top measurement. Let us find the amount and value of his ice harvest.



The sketch shows size and shape of area of ice actually cut. More ice was contained along the edges, but was too thin to be of use.

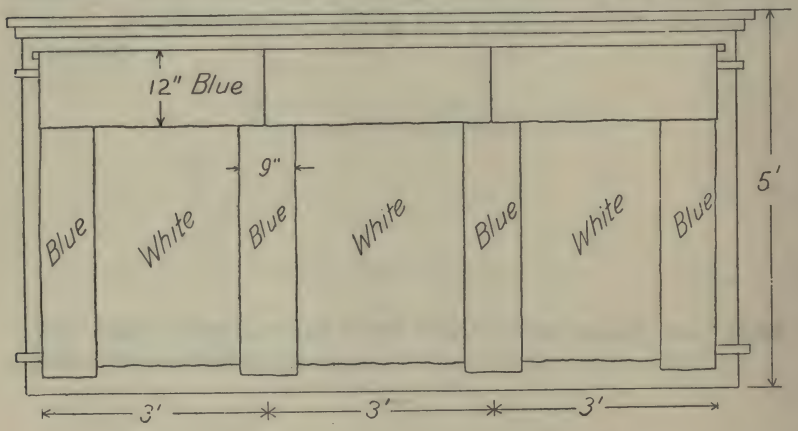
QUESTIONS

1. How many square feet of ice on the pond?
2. Making no allowance for width of cut, how many blocks were secured each cutting?
3. Ice weighs about 57 pounds per cubic foot. What was the weight of one of the blocks in the first cutting? In the second? In the third?
4. What was the weight for each cutting? For all cuttings?
5. The ice-house measured 40′ by 80′ by 20′. Allowing one quarter of this space for sawdust, was the house large enough to store the entire crop?
6. Since ice melts and evaporates, suppose one-eighth of the stored amount to be wasted, what was the value of the crop at $5.00 per ton (short ton)?

XVI

CURTAINS

At school one day, Hazel's class had a lesson on Home Furnishing. The teacher said that all rooms of the home should be furnished in a neat attractive manner. If money was scarce, much could be done by using cheap materials. Pictures were shown of plans that several girls had worked out in making their own bedrooms cheerful and "comfy" looking. Hazel thought of her own room at home, and decided that she could improve it very much, in the way of curtains. She needed help in measuring, and asked her brother William to assist her. William was not very willing to do this at first, until Hazel promised to help decorate his room.



The top piece is blue—12″ wide. Three pieces.
Four blue strips—9″ wide hang from rod.
Three white curtains—each as wide as a window, and nearly as long as the blue strips.
Blue material is cretonne—36″ wide at 25¢ a yard.
White material is scrim—36″ wide at 50¢ a yard.

QUESTIONS

1. How many yards of scrim are required for one window? For three windows?
2. How many yards of blue cretonne for top pieces? For vertical strips?
3. What is the cost of scrim? Of cretonne?
4. Pole and fixtures cost $1.00. What would be the total cost?
5. Using a scale of one inch equal to one foot, make a neat sketch of the curtain arrangement.

XVII

MONTHLY BILLS

One evening each month, every one in Earl's home worked arithmetic. On this evening father gathered all his bills together. Mother and the children checked them to see if they were correct. Earl and his sister took the meter readings each month, and checked them with the figures on the bills. Some day each of us is going to pay bills of this kind. Let us get a little practice, so that we may not lose any money due to carelessness or ignorance.

Gas

April reading—57500 cu. ft.
March reading—55200 cu. ft.
@ $1.30 per 1000 cu. ft. with discount of 10%

Electric Light

April reading—1218 K. W. H.
March reading—1179 K. W. H.
@ $0.10 per K. W. H. for first 14 K. W. H.
$0.07 per K. W. H. for second 14 K. W. H.
$0.04 per K. W. H. for third 14 K. W. H. with discount of 10%

Water

April reading—17300 cu. ft.
January reading—14400 cu. ft.
@ 0.29\frac{1}{4}$ per hundred cu. ft. with discount of 5%

Rent—$35.00 per month, deduction of $2.75 for repairs

Groceries	$ 42.65
Meat	19.16
Clothes	33.28
Telephone	2.50
Coal—2 tons at $4.80 per ton =	
Newspapers—20¢ per week (4 weeks) =	
Street Car Fare—60¢ per day (30 days) =	
Insurance and Incidentals	21.25

Receipts

Father's Wages	159.60
One Roomer	40.00
Earl's wages	30.00

QUESTIONS

1. How much money did the family receive during the month?
2. How many thousand feet of gas were used? What was the gross cost? Net cost?
3. How many kilowatt hours of electricity were used? What was the gross cost? Net cost?
4. How many hundred cubic feet of water were used? What was the gross cost? Net cost?
5. Find the total amount of all expenses?
6. How much money was placed in the bank?
7. Do you think any of the items cost too much? What ways can you suggest that would result in reducing them?

XVIII

A CLUB

One of the ways of enjoying the company of others is to form or join a club. But usually, as soon as a club is formed, expenses begin. A common way of meeting these expenses is to have the members of the club pay fees and dues. Suppose that you were appointed to take care of the money of a club. These are some of the calculations that you would be required to make.

Initiation fee, $5.00. Paid when joining.
Dues, $0.50 per month. Paid monthly.

Receipts

Members.

January admitted	8	July admitted	2
February admitted	3	August admitted	5
March admitted	2	Sept. admitted	3
April admitted	5	October admitted	2
May admitted	1	November admitted	1
June admitted	3	December admitted	2

Expenses

Two rooms rent	$12.00 per month.
Stationery	$18.00 per year.
Furniture rent	$ 5.00 per month.
Club buttons	$ 0.15 each. One given to a member.
Annual banquet	$ 2.00 per person. 25 attended.

QUESTIONS

1. How many persons did the club have as members at end of the year?
2. How much money was received from initiation fees?
3. How much money was received from monthly dues?
4. What was the total amount of money received?
5. What was the total amount spent?
6. What amount of money was in the treasury at the end of the year?
7. Suppose that the ones who attended the banquet were assessed a special fee of $1.50. What amount of money would have been left?
8. What do you think would have been a fair way of distributing the money that was left at the end of the year? How much would each member receive according to your method?

XIX

A SOCIAL

The pupils of the Continuation School were working hard to get a Victrola for their assembly room. The Victrola and records cost $100.00. The school had $19.55 in the treasury. In order to secure the rest of the money, they planned to hold a social. The tickets were printed in the school shop and cost nothing. The only expense was for food. Tickets were sold for 35¢ apiece. Each ticket entitled bearer to one cup of coffee with milk and sugar, one block of ice cream, and one ham sandwich. Two-hundred tickets were sold.

Coffee for 50 cups	**1 pound**	**@ 35¢ per pound.**
Sugar for all	**4 pounds**	**@ 7¢ per pound.**
Milk for all	**2½ quarts**	**@ 12¢ per quart.**
One loaf of sandwich bread made 12 sandwiches		**@ 20¢ per loaf.**
One pound of ham made 20 sandwiches		**@ 60¢ per pound.**
Eight blocks of ice cream to the quart		**@$2.00 per gallon.**

QUESTIONS

1. What was the amount of money received from the sale of tickets?
2. Find the amount and cost of the coffee, sugar, milk, bread, ham, and ice cream? Find the total cost?
3. What was the amount of money turned in to the treasurer?

4. How much money was lacking for the Victrola after the social?
5. What would be your plan for securing the remainder of the required amount? Show by figures your estimate of the expenses and profits.

XX

COOKIES

When the question of "what to eat" came up at the meeting of the Boy Scouts, all sorts of answers were given. The boys were preparing for a week's camping trip. Hilbert insisted upon cookies, therefore he was appointed to attend to getting the proper amount and kind. Now Hilbert's sister was noted for her molasses cookies, so Hilbert knew where to go. Sister agreed to make them, if Hilbert would make out and pay for the grocery order, and make himself generally useful. The recipe used made three dozen cookies.

	Amount	Measure	Cost
Brown sugar	1½ cups	2 cups per pound	@ 14¢ per pound
Lard	1 cup	2 cups per pound	@ 20¢ per pound
Eggs	2		@ 38¢ per dozen
Molasses	1 cup	2 cups to the can	@ 15¢ per can
Flour	5 cups	2 cups per pound	@ 8¢ per pound

Soda, ginger, and salt—2 cents.

QUESTIONS

1. In the troop were 12 boys, each boy was allowed 3 cookies per day for 7 days, how many dozen cookies were required?
2. How much of each material was required and what was the cost of each to provide the number of dozen required?

3. What was the total cost of the cookies?
4. What was the cost per dozen? Could the troop have done better by buying the cookies at a bakery?

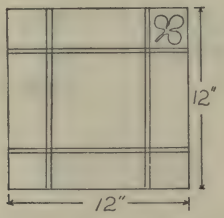
XXI

HAND EMBROIDERED HANDKERCHIEFS

While shopping for Christmas presents Anna noticed some very attractive looking hand embroidered handkerchiefs. But the price astonished her, for they were marked $1.75 each. She learned how they were made and thought she would try to make some for herself and her friends.

The process of making was very simple. A small square of linen 12″ by 12″ formed the body. The design was made by pulling out several threads or ends, and pulling in different colored mercerized threads. Some embroidering was then put in the corners.

The linen was sold in squares—12″ by 12″ for 35¢ a square. By the yard 36″ wide—it cost $2.88.



The colored thread—one skein for three handkerchiefs—6¢ per skein. Needles, thread for hemming, stencil for designs, cost about one half cent per handkerchief.

She found that the time for pulling out and pulling in the threads

for the straight line design was about one hour. One hour was required to mark and make the embroidered design, and one hour to hem and complete the handkerchief.

She planned to make 24 handkerchiefs.

QUESTIONS

1. Buying squares—what was the cost of the linen?
2. Buying linen by the yard—how many yards were required? What was the cost?
3. How many skeins of thread were used? What was cost?
4. What was total cost for needles, stencils, etc.?
5. What did each handkerchief cost her—buying squares? Buying by the yard?
6. Supposing her time to be worth 30¢ an hour, was her cost much less than the store price?
7. She secured orders for 100 handkerchiefs, selling them at $1.50 apiece. What would be her total profit?

XXII

DISPLAY CARDS

One of the first things that Mary learned when she became an apprentice to a Display Card writer, was to cut various sizes of cards from standard size sheets, with least possible waste.

The standard sheets measured 24″ by 36″.
The usual card measurements were 6″ by 9″–9″ by 12″–12″ by 18″–18″ by 24″.

QUESTIONS

1. Show your layout for cutting by a sketch. Use scale $1\frac{1}{2}'' = 1'$.
2. What is the greatest number of 6″ by 9″ cards from a standard sheet?
3. How many sheets are required for an order of 100 6″ by 9″ cards? Could waste be used for another size? What size?
4. What is the greatest number of 9″ by 12″ from a standard sheet?
5. How many sheets are required for an order of 50 9″ by 12″ cards? Could waste be used for another size? What size?
6. A special order for 100 $5\frac{1}{2}''$ by $14\frac{1}{2}''$ cards was secured. Show how you would lay this out from standard sheets. How many standard sheets are required? Could waste be used for any of the other sizes?

XXIII

REPORTS

Did you ever stop to think that teachers sometimes get tired? Elsie thought of this one morning, when she saw the typewriting teacher working away for dear life on the monthly reports. Knowing that the best thing in this life is service for others, Elsie went to the teacher and suggested that the class make an arithmetic lesson out of the reports. The teacher was overjoyed, the class was happy in the thought of helping others. This is the work they did—

There were ten pupils in the class.

	Typing	Short-hand	Book-keeping	English	Commercial Arithmetic
Florence...	85%	78%	80%	85%	70%
Charles....	80	85	90	92	90
Lydia.....	65	68	70	85	72
Murray....	90	94	88	80	95
John.....	92	88	88	84	86
Clyde.....	75	76	78	82	80
Walter.....	78	82	84	86	78
Myrtle.....	69	69	75	90	75
Helen.....	94	95	90	88	92
Gladys....	86	90	84	92	80

QUESTIONS

1. Find average grade of each pupil.
2. Find class average for each subject.
3. Rank pupils according to average grades—highest first, etc.
4. Find average grade for all pupils.

XXIV

COAL WEIGHTS

Did you ever hear of finding the weights of materials by using paper, pencil, and a ruler? It is often done. The system is very simple. Some patient people have worked out tables showing how many times heavier common materials are than the same volume of water. The number of times heavier the material is than the water, is called its specific gravity. For example, cast iron has a specific gravity of about 7.2. A cubic foot of water weighs 62.5 pounds. The weight of a cubic foot of cast iron would then be 62.5 times 7.2 equals 450 pounds. So all we have to do is to find the contents in cubic feet of a material, multiply this by 62.5, times the specific gravity of the material. The result is the weight of the material in question.

Of course, different kinds of coal have different values for their specific gravities. For our problem, we shall use a soft coal having a specific gravity of 1.28.

The coal cellar of the Garfield school, measures 22′ by 44′ by 8′.

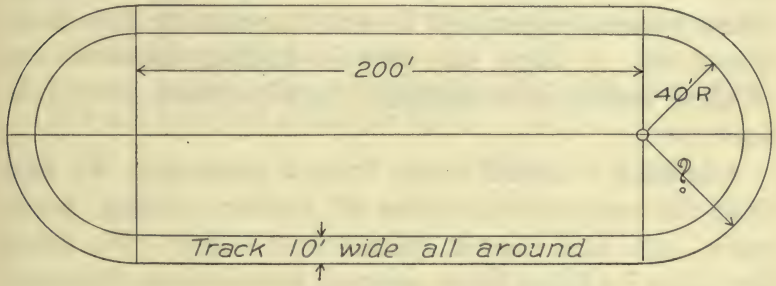
QUESTIONS

1. What would be the cubical contents of this cellar?
2. What was the weight of the coal when cellar was filled?
3. The trucks hauling the coal measured, 2′ by 3½′ by 8′. What was the number of tons (2000 lbs.) in each truck? How many truck loads were required to fill the cellar?
4. What was the cost of the coal at $6.45 a short ton?
5. Would the coal have cost less if secured from another dealer who made a bid of 17¢ per bushel? Use 25 bushels to the ton.

XXV

RUNNING TRACK

The boys and girls of the new part-time school had been wishing and working for an athletic field of their very own. It was difficult to get all the money they needed, but they were making progress by doing some of the work themselves. In the Arithmetic and Drawing classes they had worked out this plan for a track.



QUESTIONS

1. What was the total length across the track?
2. What was the total width across the track?
3. What was the distance around the track—inside?
4. What was the distance around the track—outside?
5. What was the distance around the track—middle?
6. About how many times would a runner have to go around the track to run a mile—use inside measurement? To go one-fourth mile?
7. Could a fifty yard dash be run on a straight side?
8. How would you lay out a track on a field?

XXVI

BUILDING A HOUSE

When we see advertisements in the magazines of nice looking houses at very low prices, we wonder why they can be so cheap when those around us are so expensive. The answer partly is that these houses as shipped include only a part of the total expense that enters into the building of a complete house. Some money can be saved by buying and building these houses, especially if we do some of the work ourselves. A fairly safe rule for finding the total cost of these homes is to multiply the advertised cost by at least two.

Selecting a model house from a catalogue, we find that the company furnishes all lumber, roofing, hardware, lath and plaster, paints and stains. We must furnish in addition-labor, ground, foundations, chimney, furnace, bath and electric fixtures, wiring, drains and piping. Costs, of course, vary according to time and place.

Cost of sample house, $947.00. 5% discount for cash.
Lot 40′ by 150′ @ $15.00 per front foot.
Excavating cellar, 5′ by 28′ by 22′ @ 60¢ per cubic yard.
Foundation walls, 28′ by 22′ by 7′ @ 27¢ per sq. ft., inside face.
Floor in cellar, 18¢ per sq. ft.
Chimney, $60.00
Furnace (Pipeless) $65.00
Bath set—three pieces—$75.00

Electric set—nine pieces—$65.00
Drains, piping, wiring, $225.00
2 carpenters 5 days @ $7.50 per day.
2 laborers, 10 days @ $3.50 per day.

QUESTIONS

1. Find the cost of lot.
2. Find the cost of wages for laborers and carpenters.
3. Find the total cost of chimney, furnace, bath and electric fixtures, drains, piping and wiring.
4. Find the cost of the house at 5% discount. (This discount usually amounts to enough to pay the freight.)
5. Find the cost of excavating the cellar.
6. Find the cost of foundation walls and the floor.
7. Find the total cost of house. How many times greater is this than the advertised cost?
8. Lay out your own plans for concrete walks around the house and find their cost at 25¢ per sq. ft.

XXVII

ANALYSIS

Chemists are somewhat like small boys and girls. They are always taking things apart to see what is in them. When children do this, we sometimes call it "mischief." When chemists do it, we call it "analysis." Finding exact measures of the various materials of which a substance is composed is of great value in the industrial world. It makes us able to compare the values of different substances, and enables us to duplicate the same substance. A chemist can take samples of several kinds of coal, analyze them and tell which is the best for certain purposes. The amounts of the various materials contained in a sample are usually expressed in per cents.

An example follows—

	#1 Coal 2 pound sample	#2 Coal 2 pound sample
Moisture	.0252 pounds	.0866—does not burn
Volatile matter (gases)	.6024 pounds	.6730—does burn
Carbon	1.1922 pounds	1.1100—does burn
Ash (earthy matter)	.1646 pounds	.0990—does not burn
Sulphur	.0156 pounds	.0314—does burn

QUESTIONS

1. Do the weights of samples #1 and #2 total two pounds each?
2. Find the weights of the materials that burn in each sample?
3. Find the per cents of each material in each sample.
4. Suppose we had one ton (2000 pounds) of #1 coal, what would be the weights of each material?
5. Suppose we had one ton (2000 pounds) of #2 coal, what would be the weights of each material?
6. In a ton of coal of each sample, what would be the weights of the materials that burn?

XXVIII

CANDY MAKING

Robert and Helen Smith, finding that they needed a little extra money for Christmas, decided that they would become candy manufacturers. Helen said that she would furnish the brains, if Robert would furnish the muscle. Helen tried the following recipe for fudge and found that it made a good quality of candy.

Materials for one pound of fudge.

1½ squares of chocolate	¼ cup of corn syrup
½ cup of milk	1 tablespoon of butter
2 cups of sugar	1 teaspoon of vanilla

Measures and costs.

2 cups of sugar to the pound	@ 7¢ a lb.
4 cups of milk to the quart	@12¢ a qt.
32 tablespoons of butter to the lb	@64¢ a lb.
15 squares of chocolate to the lb	@60¢ a lb.
2 cups of syrup to the can	@20¢ a can.

Vanilla costs 1¢ per pound of fudge
Sacks cost 10¢ a hundred.
Candy was put up in ¼ lb. sacks.

Of course, the first question that came up was the selling price. Bob said that 60¢ per pound would give a fair profit. Let us see if he was right in his estimate.

QUESTIONS

1. What was the cost of the materials for one pound of candy?
2. What was the profit on ten pounds of fudge? Don't forget to count the cost of sacks.

At first, when the business was small, Mother said nothing about cost of the gas. Neither did the children count in the cost of their time. They agreed to pay 16¢ an hour for the gas. They found that they could make 8 pounds of fudge in one hour. After talking for some time, they decided to pay themselves 50¢ each for an hour. Any money over this was to be given to Mother. They made and sold 64 pounds per week.

3. What was the cost of one pound of fudge under the new arrangement?
4. How many hours a week did they work? What did they pay themselves per week?
5. What was the total amount received for the week's work?
6. What did they give Mother for her share at end of the week?
7. Make out the grocery order for the materials for the week giving the amounts and costs of the different articles.

XXIX

VANILLA EXTRACT

Many a manufacturing business that now requires a great building and hundreds of employees, has had its start in a small kitchen or basement. For instance, some one has discovered a good formula for making a simple thing like vanilla extract. He has made up a few gallons, and has found a ready sale for his product. Soon he is using all his time, instead of only spare time, and soon larger quarters are needed. But if the business is to be successful, care must be taken in calculating the selling price so that a fair profit may be secured. This problem will give some guide as to the various costs entering into the manufacture of such an article.

Ingredients and cost for One Gallon of Vanilla Flavoring Extract

Vanilla	$0.38	Sugar	$0.12	Syrup	$0.18
Caramel	0.29	Prunine extract	$0.27	Alcohol	0.85

Materials for packing

Bottles—one oz. bottles	$2.88 per gross
Corks-	0.36 per gross
Labels-	0.50 per thousand
Cartons—one doz. bottles per carton	4.00 per hundred

Output is 60 bottles per hour.
One gallon contains 128 fluid ounces.
The first lot of mixture made was 3 gallons.

QUESTIONS

1. What was the total cost of ingredients for the three gallons?
2. How many ounces were contained in the three gallons?
3. How many bottles were needed for this amount? Cost?
4. How many corks were needed for this amount? Cost?
5. How many labels were needed for this amount? Cost?
6. How many cartons were needed for this amount? Cost?
7. What was the cost of ingredients and containers for this amount?
8. How long did it take to make the three gallons? Allowing himself 50¢ an hour for labor, what was cost of his labor?
9. Allowing himself a profit of 12% on whole cost for this amount, what would be his selling price per carton?
10. As business developed, twenty hours per week were devoted to the work. What would be total expenses, total profit, total receipts, on this amount of business?

XXX

THE BUSIEST CORNER

One of the necessary conditions for success in a store or shop, is a proper location. Naturally, the store that is located in the busiest section of the city, is most likely to get the greatest business. Business men sometimes go to a great deal of trouble and expense to find the busiest sections, then pay high prices for storerooms located in these places. One method of finding the busiest section is to station men at promising corners, and have them make and keep accurate counts of the number of people passing for certain intervals, at various times of the day.

A record of such a plan follows—

#1 Corner—Main and Adams N. E.
#2 Corner—Main and Adams S. E.
#3 Corner—Hamilton and Sixth N. E.
#4 Corner—Hamilton and Sixth S. E.
The record shows a count for one day.
Two counts, three minutes long were taken each hour.

Hours	Corner #1		Corner #2		Corner #3		Corner #4	
	Count 1	Count 2	Count 1	Count 2	Count 1	Count 2	Count 1	Count 2
8–9	12	18	15	20	20	40	15	35
9–10	36	45	35	50	80	70	35	40
10–11	40	18	40	22	48	36	70	89
11–12	60	75	80	60	90	110	50	60
12–1	100	120	120	140	110	120	80	90
1–2	80	60	90	40	40	60	30	50
2–3	120	140	116	38	60	85	60	40
3–4	90	100	80	120	110	120	30	18
4–5	120	85	130	100	120	140	100	80
5–6	100	80	130	120	145	130	80	56

QUESTIONS

1. Find the totals and averages for each corner for the day.
2. Which corner was first, second, third, fourth?
3. Find the totals and averages for each corner for each hour?
4. Suppose you were starting a restaurant serving special meals at 8–10, 12–2, 4–6, which corner would be your first choice? Your second?

XXXI

MAILING CLERK

As James had worked hard and faithfully during his year and a half with the Acme Publishing Co., his employer promoted him. His new job was to take charge of all the mailing. He had to be sure that the proper postage was placed on all parcels and letters and that they were delivered to the postoffice. Before he started, he went to the postoffice and secured a postal guide, and a postal zone map and key. His office was already supplied with a set of scales.

Let us follow him during one of his busy weeks.

From his postal guide he learned that the rates on parcels were as follows for 10 lb. parcels.

Zone 1, up to 50 miles	**$0.14**	**Zone 5, 600 to 1000**	**$0.62**
Zone 2, 50 to 150 miles	**$0.14**	**Zone 6, 1000 to 1400**	**$0.81**
Zone 3, 150 to 300	**$0.24**	**Zone 7, 1400 to 1800**	**$1.01**
Zone 4, 300 to 600	**$0.43**	**Zone 8, over 1800**	**$1.20**

All his parcels were of the same weight—ten pounds—

22 from Chicago to St. Louis.
43 from Chicago to New York.
10 from Chicago to Pittsburg.
12 from Chicago to Philadelphia.
18 from Chicago to Indianapolis.
6 from Chicago to San Francisco.

Beside the parcels, there were a number of registered letters. The charges for these are 2¢ for each ounce or fraction thereof and a fee of ten cents per letter.

He mailed 10 registered letters weighing 3½ ounces each.
15 registered letters weighing 4¼ ounces each.
25 registered letters weighing 5½ ounces each.

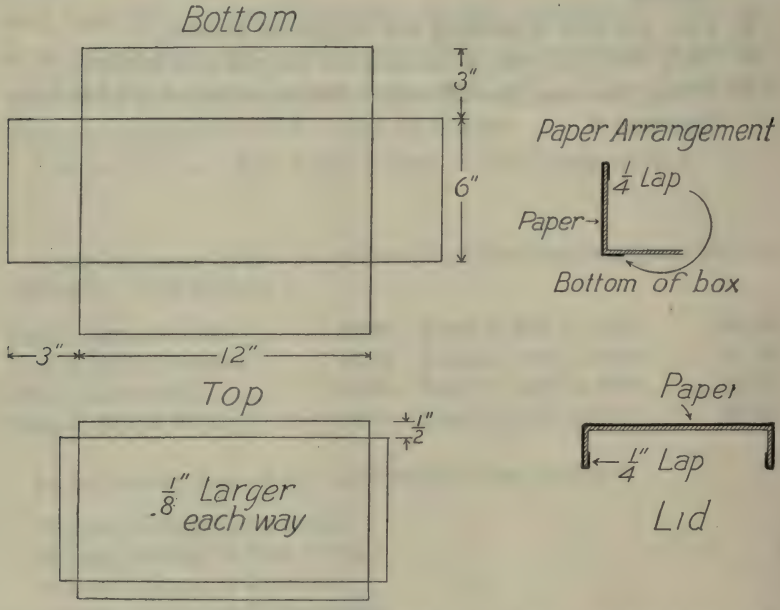
QUESTIONS

1. Find on your maps the distances of the various places above from Chicago. Mark in what zones they come.
2. Make out a table showing number of parcels mailed to each zone. Charge for parcels to each zone. Total charges.
3. Find the cost of mailing the registered letters.
4. Find the total cost of mailing the parcels and letters.
5. Using your own postoffice as a center make out a table as in Question 2.

XXXII

BOX MAKING

After working in the box-factory for eighteen months, Anna learned her work so well, that her forelady often called upon her for assistance. Anna being very good in Arithmetic, helped make out requisitions for material when new sizes of boxes were ordered. The boxes were made of pasteboard cut as shown by the sketch.



Tops were made about one eighth of an inch wider and longer than the bottoms. When the flaps were folded,

stout pieces of binding were glued at the joints. After joining, strips of paper were pasted on edges of the bottom pieces, and on tops and edges of the lids.

QUESTIONS

1. How deep was the box when made?
2. What was the size of the piece for the bottom? How many could be cut from a standard sheet 3′ by 6′?
3. The lids came down one-half an inch over sides of the box. What was the size of the piece for the lid? How many pieces for lids could be cut from a standard sheet 3′ by 6′?
4. What would be length and width of the strip of paper required to go around the edge of the bottom, as shown by the sketch?
5. What would be the length and width of the strip of paper for the top and edges of a lid, as shown by sketch?
6. The paper came in 36″ widths and 60 yard rolls. Make out an order for pasteboard and paper required for 2000 boxes.

XXXIII

BONUS SYSTEM FOR SALES GIRLS

A new manager had been engaged in Marsden's Department Store. Of course, new managers always have new ideas. The most interesting of the new ideas was one by which the sales-girls were to receive bonuses for good records. The entire plan cannot be given here, neither can the records of all the sales-girls. It was something like this—

1. To the first three girls having greatest number of customers during the week, bonuses of $0.75 to the first, $0.50 to the second, $0.25 to the third were given.

2. For greatest numbers of buying customers—$1.00—$0.75—$0.50

3. For greatest numbers of actual sales —$1.00—$0.75—$0.50

4. For greatest values of actual sales —$1.00—$0.75—$0.50

We shall take the records of five girls.

	Mary Jones	Lucy Hanks	Anna Fisher	Ruth Gray	Agnes Bolt
Number of customers	48	36	54	102	86
Number of buying customers	44	30	27	84	85
Number of sales	85	69	86	101	94
Value of sales	$258.12	$315.65	$225.15	$198.29	$98.35
Number of returned sales	14	0	18	12	0
Value of returned sales	$ 70.00	0	$ 69.12	$ 34.56	0

1. Mark the rank of the girls and amount of bonus, using a form like this:

	Greatest no. of customers	Greatest no. of buying customers	Greatest no. of actual sales	Greatest value of actual sales
Mary Jones.....				
Lucy Hanks.....				
Anna Fisher.....				
Ruth Gray.....				
Agnes Bolt.....				

QUESTIONS

2. What were the total amounts received as bonuses by each of the girls? Rank the girls according to their amounts of bonus. Do you think this final rank shows the best sales girl?
3. Find totals and averages for all of the items: number of customers, number of buying customers, etc.
4. Find the percentage of buying customers for each girl.

XXXIV

PAY ROLL

In making up the required amount of money used in paying a number of people, care must be taken to get the exact amount of money and exact number of pieces. It wouldn't please you very much, if the paymaster made you wait while he sent a messenger to get correct change.

In a small factory we have the following conditions—

19 men worked ten hours per day—five hrs. on Saturday—2 hrs. overtime on Saturdays.

15 women worked 9 hours per day—five hrs. on Saturday—no overtime.

18 boys & girls worked 8 hours per day—five hrs. on Saturday—6 of these attended Continuation School on Monday, 6 on Tuesday, 6 on Wednesday.

The men received 52¢ per hour. Time and a half for overtime.

The women received 38¢ per hour.

The boys and girls received 26¢ per hour, not paid for time in school.

Monday the 6th was a holiday, nobody worked. No Sunday work.

Calendar

Sun.	Mon.	Tue.	Wed.	Thur.	Fri.	Sat.
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15			

1. Make out a table for amounts of pay as follows:

	Days	Hr. per da.	Rate per da.	Over-time	Rate per hr.	Amount
Men.....						
Women.....						
boys & girls...						
Mon						
boys & girls...						
Tues.....						
boys & girls...						
Wed						

2. Make out money list, so that proper pieces and amounts can be paid to each.

	$10.00	$5.00	$2.00	$.50	$.25	$.10	$.05	$.01	Total
19 men.....									
15 women.....									
6 boys & girls..									
Mon.....									
6 boys & girls..									
Tue.....									
6 boys & girls..									
Wed.....									
Total.....									Check

XXXV

DISTRIBUTING BILLS

You have often noticed on your way to work or to school posters and hand bills advertising some new article of food, dress, or machinery. When a company introduces a new article of any kind in a city, much money is paid for the advertising. Usually one man is given charge of this work. He attends to having large posters placed on bill-boards, the placing of "ads" in the news papers, the distribution of hand-bills and samples.

The agent in charge of a job like this had among other things, 20,000 bills and samples of a new soap "Cleanite," also about 200 metal signs. He desired to have the work done in a week of six days, hiring 3 boys to distribute bills and samples and to tack up signs.

The average time for a boy on one side of street for a block—25 houses—is about ten minutes. This includes the time for tacking up signs.

The boys were paid 25¢ per hundred for the bills and samples—one bill and one sample to each house—and 3¢ apiece for tacking up the signs.

The record of the boy's work was—

	James		Harry		William	
	Bills & Samples	Signs	Bills & Samples	Signs	Bills & Samples	Signs
Mon	950	14	850	12	1350	5
Tue	1025	18	950	18	1250	12
Wed	950	10	1250	10	1000	12
Thur	1250	5	975	5	1150	14
Fri	1300	10	1350	12	800	9
Sat	1250	6	1100	18	1250	10

QUESTIONS

1. How many bills and samples were distributed by James? Harry? William? All?
2. How many signs were tacked up by James? Harry? William? All?
3. How much money did James make from bills and samples? From signs?
4. How much money did Harry make from bills and samples? From signs?
5. How much money did William make from bills and samples? From signs?
6. Make a table showing the number of hours each boy worked per day.
7. What was the average hourly pay received by James? Harry? William?
8. What was total cost to the agent for this work?

XXXVI

AUTO TRIP

Mr. Jones had been planning for many weeks to spend his vacation by taking an auto trip. As the time for departure drew near, his neighbor proposed that he and his wife accompany them. The party as arranged consisted of Mr. Jones, his wife and son Harry, Mr. and Mrs. Harris. It was agreed that Mr. Jones would use his own car, pay all bills and arrange for a settlement with Mr. Harris at the end of the trip.

The estimated expenses for the week were as follows:

Distance traveled 500 miles.

Car averaged 12 miles per gallon of gasoline. Cost 25¢ per gallon.

Car averaged 200 miles per gallon of oil. Cost 90¢ per gallon.

Wear on tires—tires good for 4000 miles—cost new $120 per set of four.

Meals 7 dinners @ 75¢ per meal per person.

Meals 7 lunches, @ 25¢ per meal per person.

Meals 7 Breakfasts @ 40¢ per meal per person.

Rooms—two rooms per night— 7 nights at $1.50 per room per night.

Extras—candy, postcards, shows, etc., $30.00.

Repairs to car—$25.00.

QUESTIONS

1. Find the cost of meals.
2. Find the cost of rooms.
3. How many gallons of gasoline were used? What was the cost?
4. How many gallons of oil were used? What was the cost?
5. What was the cost of tires per mile, figuring that the set when new would last for 4000 miles?
6. What was total cost of the trip? Cost per person?
7. What would be the amount of Mr. Harris' share for himself and wife?
8. What was the cost of the trip per mile?
9. Considering only oil, gas, repair and tire wear what did it cost to run the car per mile?

XXXVII

BUYING A HOUSE

Many people live in the same houses, paying rent year after year. At the end of ten or twelve years, they have nothing to show for their money except a bundle of rent receipts. Of course it is not always desirable to buy a property, but many people now paying rent, should own their homes.

There are many ways open for a person whose bank account is not large, to purchase his home.

1. By paying a certain amount of cash, and securing the rest of the amount by giving a mortgage.
2. By paying a certain amount monthly to the owner.
3. By securing money from a Building and Loan Association or bank.

Mr. Adams pays $40.00 a month rent.

He has $1500 in the bank.

He can buy a house for $4500.00 through the Building and Loan Association by paying $1500 down; $1.09 per $100, every month for eleven years on the remainder.

Or he can secure a loan of $3000 from a bank, agreeing to pay $300 on the principal each year and 6% interest per year.

Expenses for taxes, insurance, repairs, amount to $114 per year.

QUESTIONS

1. Paying Rent

1. How much would rent amount to in one year? In 11 years?
2. How much interest would he receive on his $1500 at 3% in one year? In 11 years?

2. Buying Through Building and Loan

1. After paying $1500 down, how much would he owe Building and Loan?
2. At a charge of $1.09 per month for every $100.00 owed, what would be his payments to the Building and Loan each month? Each year? For eleven years?
3. Counting in his expenses of $114 per year, what would his total payments amount to in the 11 years?

3. Through the Bank

1. Paying $1500.00 down, how much would he owe the bank?
2. Paying $300.00 each year, how long would it take to pay the balance owed the bank?
3. At 6% interest each year, what would be interest payments for this time?
4. Counting in his expenses of $114.00 per year, what would be his total payment by this plan?

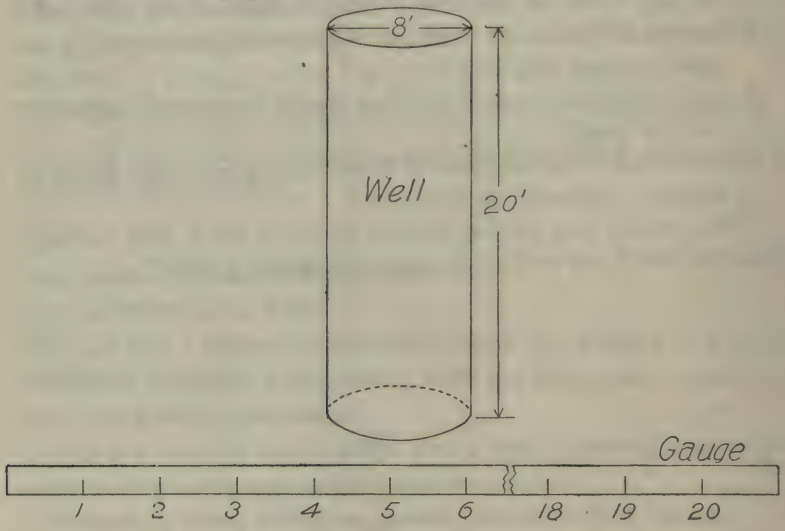
What would you advise him to do—pay rent, buy through Building and Loan or buy through the bank? Why?

XXXVIII

A WELL

Often during the long dry "spells" in the west, Mr. Woods, a farmer, became very anxious about the quantity of water remaining in his well. When the water became very low it was necessary to haul a supply from a distance. After watching his father peer into the dark well, Harry was struck with an idea. His idea was to get a long strip of wood, mark foot lengths on it, then plunge it down to the bottom. While this gave him the depth of the water, it did not give him the quantity. Let us make the calculations necessary to complete Harry's idea.

The well was 20′ deep, circular in form, with an 8′ diameter.



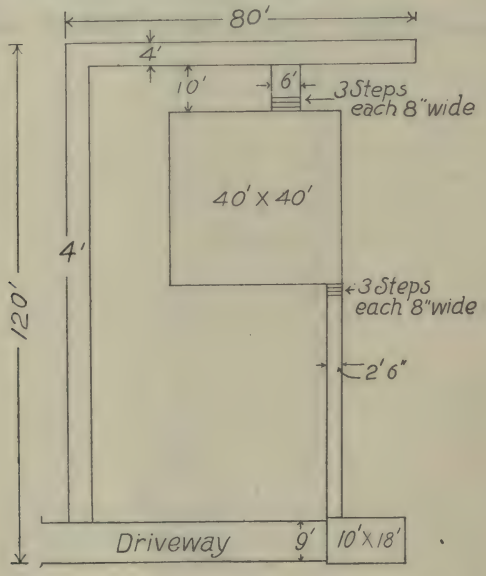
QUESTIONS

1. Suppose there was a one foot depth of water in the well, how many cubic feet of water would that represent?
2. A cubic foot of water contains $7\frac{1}{2}$ gallons, how many gallons of water for a one foot depth?
3. What would be the quantity of water in the well when full?
4. Make a table giving the quantity of water (gallons) for each foot depth of water.
5. Show by a sketch how you would make the gauge so that quantity of water could be read quickly.
6. Can you think of a better idea than Harry's for finding the quantity of water in a short time?

XXXIX

CEMENT WORK

Nearly every property owner has some concrete work about his house. We all know how much a fine smooth concrete walk adds to the appearance and value of a property and to the comfort of the people using the walk. While many people can do their own concrete work (directions for making and laying being easily secured from the cement dealer) it is better perhaps, if it can be afforded, to get a regular contractor to do the work, especially the finer parts.



From the sketch of the property make an estimate of the cost of the concrete work.

The contractor quotes a price of
$1.80 per sq. yard for walks
$2.25 per sq. yard for driveway and garage floor.
$3.50 per 6′ step.
$2.00 per 2′ 6″ step.

QUESTIONS

1. Find cost of front steps? Of rear steps?
2. Find sq. feet of garage floor? Square yards? Cost?
3. Find sq. feet of driveway? Sq. yards? Cost?
4. Find sq. feet of rear walks? Square yards? Cost?
5. Find sq. feet of front walks? Square yards? Cost?
6. Find sq. feet of front pavement? Square yards? Cost?
7. Find sq. feet of side pavements? Square yards? Cost?
8. What is total cost?
9. Suppose that you were the owner of the property and wished to have a walk around the house. Make a sketch of what you would want and calculate its cost.

XL

PICTURE FRAMING

George Miller, being skillful in the use of wood working tools, secured the work of framing pictures for a dealer during the holiday rush season. He was to receive a profit of 50% or one half of the cost of each picture.

He bought three grades of 1″ molding.

Grade #1	**40¢ per ft.**
Grade #2	**25¢ per ft.**
Grade #3	**15¢ per ft.**

The pictures were to be made in four sizes.

Size #1 18″ by 20″.	**Glass cost 60¢.**	**Back 15¢**
Size #2 15″ by 18″.	**Glass cost 50¢.**	**Back 10¢**
Size #3 12″ by 15″.	**Glass cost 40¢.**	**Back 6¢**
Size #4 10″ by 12″.	**Glass cost 30¢.**	**Back 4¢**

Glue, nails and paper cost about 2¢ per picture.
Make an allowance of two inches waste molding for each picture.

QUESTIONS

1. His first order called for four pictures—Grade #1 Size #2. What was the amount of his profit on this order?
2. A second order called for six pictures—Grade #3 Size #4. What was the amount of his profit on this order?
3. The third order called for five pictures—Grade #2 Size #3. What was the profit on this order.

4. The material for the back came in pieces 4 ft. wide and 8 ft. long. It cost 5¢ per ft. length. How many pieces could be cut for Size #3, from one of these pieces? Is the price given for this size back correct? The back is set in three-fourths of inch from the outside of the frame.

XLI

HOW LIFE IS SPENT

It is always interesting to hear elderly people talk. They are able to give us lots of information and advice, and sometimes they make surprising statements. One elderly gentlemen was talking to a group of children. He said "I have lived for seventy years, but have been awake for only forty." The children talking among themselves decided that he must have had "sleeping sickness." Their teacher gave them a problem like this next day, after solving which, they discovered that there was nothing unusual about the old man's statement.

The time of the average person per day is spent in this way—

Sleeping	**8 hours**
Eating	**2 hours**
Washing & Dressing	**1 hour**
Working	**8 hours**
Recreation	**5 hours**

QUESTIONS

1. What part of the whole day is spent in each occupation?
2. In seventy years, what would be number of years and months spent in each occupation?
3. Make a chart showing for each occupation, the amount of time spent. Use a vertical scale of 1 inch equals 16 years.
4. Make a daily schedule of your own activities, what part is spent in each occupation?

LXII

BASKET BALL TEAMS

The basket-ball season in Tabbot City was a great success. Two leagues had been formed, one for girls and one for boys. There were eight teams in each league. At the end of the year, the official standings of the clubs were carefully worked out by the secretaries of each league. The records were as follows—

	Boys		Girls	
	Won	Lost	Won	Lost
Lincoln	7	9	9	3
Washington	8	10	11	5
Vocational	14	4	8	7
Douglass	13	5	9	8
Garfield	10	5	3	13
Madison	3	13	7	6
Blaine	7	10	8	8
Allen	5	11	5	10

The method used in rating the teams was the same as is used in "Big League Baseball"—the number of games won is divided by number of games played; the result is usually carried to three decimal places; in case three decimal places fail to show any difference, four and even five places are used. Example—Lincoln girls played 12, won 9, rating is shown by dividing 9 by 12—result .750.

QUESTIONS

1. Find the rating of each of boys teams. Arrange them in order—highest first, lowest last.

Team	Played	Won	Lost	Rating

2. Do the same for girls teams.
3. Could this system of rating be used to show best sales-girl in a store? Explain your plan.

XLIII

COMMISSION PAYMENTS

The factory having closed, John was thrown out of employment. As his people needed money, he tried everywhere to get some kind of a job. About the only position open was one as house to house agent for a brush and broom company. The company agreed to furnish a sample set of the brooms and brushes, material for advertising, and whatever stationery, bills, order slips, and receipts he might need.

He was to receive 20% commission on weekly orders up to $30.00.

He was to receive 30% commission on weekly orders when over $30.00.

He was also to receive 10% on all money that he collected.

He worked for eight weeks, during which he did the following business.

Week	Brushes	Price	Brooms	Price	Amount of Orders	Money Collected	Comm. on Sales	Comm. on Collect.
1	20	0.35	18	0.50	16.00	10.00	3.20	1.00
2	25	0.35	36	0.50	?	15.00	?	?
3	21	0.35	42	0.50	?	16.00	?	?
4	31	0.35	36	0.50	?	11.00	?	?
5	18	0.35	10	0.50	?	8.00	?	?
6	36	0.35	40	0.50	?	12.00	?	?
7	32	0.35	45	0.50	?	13.00	?	?
8	15	0.35	10	0.50	?	6.00	?	?

QUESTIONS

1. How many brushes did he sell in all? What was his average per week?
2. How many brooms did he sell in all? Average per week?
3. How much money did he collect?
4. Copy the schedule and fill in columns 6, 8, 9.
5. What were his total earnings for the eight weeks? Average per week?
6. Later he was offered the agency for the city. He was to hire and pay all help, to sell 100 brushes and 200 brooms each week. For his work, he was to receive a straight commission of 40%. He arranged to pay his helpers 25%. Judging from his own record, how many helpers did he need? What was his profit under these new conditions?

XLIV

STOCK ROOM

In addition to her duties of distributing and collecting the mail, Elsie had charge of the office supply stock room for Mack & Co. Each Saturday, she sent the order to the retail people next door for the material that would be needed for the following week. In order to avoid counting each article each week, she kept a careful record of all material received and distributed. Let us check Elsie's work for one week.

She had on hand Monday at 8 o'clock—

6 reams—9″ by 12″	White typewriting paper—plain.
5 reams—9″ by 12″	Company's Letter Heads.
4 boxes	Carbon sheets.
6 gross	Copying pencils—6 doz. per box.
8 gross	Envelopes—large—one gross per package.
10 gross	Envelopes—small—one gross per package.
3 dozen	Erasers—one doz. per box.
3 dozen	Pen Holders—one doz. per box.
3 boxes	Pens—assorted styles.
800	One cent stamps.
1000	Two cent stamps.

Her records showed the distribution of the following material—

Monday —1 ream paper, plain—2 dozen pencils—125 two cent stamps—14 pen holders—2 erasers—8 dozen envelopes, large—6 dozen envelopes, small.

Tuesday —200 one cent stamps—2 boxes carbon paper—2 reams letter head paper—6 dozen envelopes, small.

Wednesday—12 erasers—1 box pens—2 dozen pen holders.
Thursday —2 reams paper, plain—2 dozen copying pencils—200 two cent stamps—12 dozen envelopes, large.
Friday —400 two cent stamps—125 one cent stamps—12 dozen copying pencils—2 reams paper, plain.
Saturday —12 dozen envelopes, small—2 dozen pencils—1 box pens.

QUESTIONS

1. Make a statement showing amount of each material distributed during the week.
2. Make a statement showing amount of each material remaining at close of business, Saturday.
3. She tried to keep her stock up to amounts shown at first. Make out a statement of her order for the following week. Of course she did not order broken lots of material.

You may follow this outline in making your statement—

	Monday On hand	Distributed	Saturday On hand	Ordered
Paper, plain—6 reams.....		5 reams	1 ream	5 reams

XLV

STOCKS AND BONDS

The special delivery letter was received with much surprise by Margaret. She and her widowed mother were not accustomed to receiving much mail, certainly not special delivery letters. The letter was examined thoroughly on the outside. They discovered the name of a town in California. Since this did not enlighten them very much, they finally decided to open it. By the letter they were informed that Mrs. Stowe had been left a legacy of $3000.00 by a long forgotten cousin who had located in the west. After the first surprise was over, plans for spending or taking care of the money were in order. After much debate Mrs. Stowe said, "I don't know much about financial matters, we might invest this money somewhere and lose it all. Tomorrow, I shall go to Mr. Edsall's bank and get advice." Mr. Edsall advised that a certain portion be deposited in the bank at 3½% interest. The rest to be invested in such stocks and bonds as the bank authorities considered safe.

Mr. Edsall bought for her:

	Market Value	Par Value Each	Int.
6 U. S. Government Bonds	$ 98.00	$100	4%
3 City School Bonds	103.00	100	3½%
3 Shares—N. Y. C. & H. R. R. Stock	85.00	100	5%
4 Shares—D. L. & W. R. R.	95.00	100	6%
8 Shares—Goldedge Rubber Stock	45.00	50	10%
4 Shares—Acme Steel	56.00	50	12%

QUESTIONS

1. Find the total cost of stocks and bonds purchased.
2. How much was left to be deposited in the bank at 3½%?
3. Find the total amount of interest on stocks and bonds and bank deposit at end of the year.
4. On the last day of the year Mrs. Stowe went to the bank, and Mr. Edsall explained all about the results of the investments. He said if you sell out your holdings today, the market values of the stocks and bonds are—U. S. Bonds, $98.50—City School Bonds, $102.00—N. Y. C. Stock, $89.00—D. L. & W. Stock, $100.00—Rubber Stock, $48.00—Steel Stock, $50.00. Suppose she had sold out her holdings that day, counting in her bank deposit, interest, and receipts from stock and bond sales, what would have been the amount of her money?

XLVI

BUYING AN AUTO

When we walk or ride through the city streets, it seems that automobiles are everywhere. When we read reports of the number of cars owned in the different states, we find that one person out of every fourteen has a car. Sometimes we wonder where all the money comes from. "Mr. Hyatt bought a car, though I know he did not have enough money saved to pay for it." But Mr. Hyatt did as many other people have done, he paid a certain amount at the time of purchase, and gave notes for the balance. Many dealers arrange to sell you a car by dividing the balance into twelve payments. Of course, they charge interest for the money which they have really loaned you. It may be that when your Father is arranging to buy a car, you may assist him in finding what would be the amounts of his monthly payments.

Cost of car	**$1050.00**
Paid cash	**450.00**

Balance is divided into 12 payments.
Interest charge is 6%.

QUESTIONS

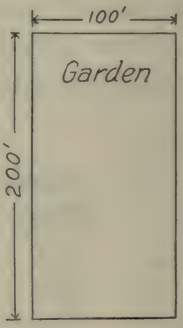
1. How much money is still due?
2. If the balance is divided into 12 payments, what would be amount of each payment?
3. What would be the interest charges for first, second, third, etc., months?
4. What would be the total amount paid at the end of twelve payments?
5. Insurance, $15.50 per year. License, $8.50 per year. Monthly maintenance, gas, oil, rent, $25.00. What would be the total expenses per month?
6. About how much salary should a man get to afford a car like this?

XLVII

A GARDEN

"Well, this corn certainly tastes good! That boy of ours is getting to be some farmer." Mr. Jenkins looked proudly at his son Robert, who was looking a little embarrassed at all of this praise. He was very fair minded though, so he said "Jennie helped a lot to make the garden a success." In the long winter evenings, Robert and Jennie had talked about their garden. They did all the planning and all the work themselves. Father gave them free use of a small plot of ground. The produce was sold to Mrs. Jenkins and the neighbors. At the end of the season they handed this statement to their father—

Tomatoes	23	bushels	@	$0.42 per bushel
Cabbage	49	heads	@	0.04 per head
Corn	81	dozen	@	0.19 per dozen
Beans	19	bushels	@	0.45 per bushel
Celery	207	bunches	@	0.08 per bunch
Potatoes	14	bushels	@	1.03 per bushel
Onions	3	bushels	@	1.21 per bushel
Asparagus	11	bunches	@	.15 per bunch
Rhubarb	26	bunches	@	.03 per bunch
Peas	5	bushels	@	.93 per bushel
Lettuce	57	heads	@	.05 per head
Beets	29	bunches	@	.03 per bunch
Lima Beans	1½	bushels	@	.88 per bushel
Turnips	3	bushels	@	.37 per bushel



Peppers, carrots, eggplants, pumpkins	**$4.95**

Expenses

Seeds	**$10.82**
Plowing	**10.50 per acre**
Fertilizer	**8.50**
Tomato, celery, cabbage plants	**10.50**
Insectides	**4.54**

QUESTIONS

1. About how many acres were in the plot?
2. What was the amount of expenses?
3. What was the amount of receipts from sale of the produce?
4. What was the net profit?

XLVIII

BERRIES

Business and pleasure form about the best combination we can find. And the boys and girls were certainly combining these on this fine July morning. They had formed a "berry picking" party. Leaving the city early they had arrived in the mountains in the cool of the morning. The berries fairly jumped into the pails. And aside from the fun, they were going to secure funds for their Winter Social Club by selling some of the berries, and by making and selling preserves. We cannot have any figures on the fun they had, but we can have some on the berries they picked.

There were twelve in the party. Each one picked ten quarts of berries. All berries not made into preserves were sold to a dealer at 22¢ per quart.

In the preserves, equal measures of berries and sugar were used. One quart of berries required one quart of sugar. One pint of sugar weighs a pound. One quart of sugar and one quart of berries made about four glasses of preserves.

Sugar cost 2 pounds for 15¢.

Preserve glasses cost 60¢ per dozen (lids included).

Paraffin cost one-half cent per glass.

Preserves were sold for 22¢ per glass.

264 glasses of preserves were made and sold.

QUESTIONS

1. How many quarts of berries were used for the 264 glasses of preserves?
2. How many quarts of berries were sold direct? What was the amount of money received for them?
3. How many pounds of sugar were required for the 264 glasses of preserves? What was the cost?
4. How many dozen glasses were needed? What was the cost?
5. What was the cost of paraffine?
6. What was the total cost of preserves? Total amount received for them?
7. What was the total of receipts from the sale of the berries and preserves?
8. What was the net profit?
9. What items of expense have been omitted?

XLIX

TAXES

Whenever a number of people get together and form a society or club, it seems that the first question that comes up is "How much are the dues?" When we belong to a sewing club or basket-ball team we pay dues. We know that certain expenses must be paid and that each of us should pay his share. Now, we all belong to the greatest club on earth—The United States of America—and as is natural we are each going to pay our share of the club's expenses when we grow up. Then the payments will not be called dues, but taxes. We do not have space enough here to explain about all the different kinds, so we shall consider general city taxes only.

In the beginning of the year, the Councilmen meet and estimate the amount of money that will be needed for the coming year. This is called "making a budget." From the assessor they secure a list giving total valuation of taxable property. Then dividing the valuation of taxable property into amount of money required as shown by the budget, they get the tax rate.

A specimen budget for a city follows—

Fire Department	30 men	$150 each per month
	New equipment	$50,000 per year
	Operating expenses	$1000 per month
Street Department	Sweeping & flushing	$3500 per month
	New pavement	$15000 per year
Police Department	Salaries	$4500 per month
	Equipment	$2500 per year
Parks	Salaries	$1800 per month
	Maintenance & Equipment	$1800 per year
Street Lighting		365 days at $120 per day
Office expenses		$350 per month
Sinking fund		$18000 per year
Salaries of clerks and heads of departments		$20000 per month

Assessed valuation of taxable property $25,928,000

The tax levy was made on two-thirds of this assessed value.

QUESTIONS

1. Find the total amount of the budget for the year.
2. Find the tax rate.
3. Harry's landlord owned three properties. The assessed value of the first was $3600, of the second $7200, of the third $10800. What was the amount of tax for each property?
4. Did you ever pay taxes? What kind? How much?

L

VALUE OF A HIGH SCHOOL EDUCATION

The boys and girls of the eighth grade of the Irving School, were discussing plans for the coming year. Some were going to enter High School, some were going to leave school in order to work. Benjamin Addison, in particular, was entirely in favor of leaving school. He was saying "I want to go out and earn some money. If I go through High School, there are four years wasted." It is hard for boys and girls to understand that each day spent in High School is worth money — real money — as much as three or four dollars for each day. Maybe you don't believe this. Some children in Brooklyn, N. Y., did not believe it, so their teachers made a study of the wages earned by many boys and girls who left school when they were fourteen, and of wages earned by others who completed the High School course. This is what they discovered—

Age	Average wages of children leaving school at 14	Average wages of children leaving school at 18
14–16	$200 per year	0
16–18	250 per year	0
18–20	350 per year	$ 500 per year
20–22	475 per year	750 per year
22–24	575 per year	1050 per year
24–25	600 per year	1150 per year
25–26	688 per year	1550 per year

QUESTIONS

1. Find the total amount of money received by first group.
2. Find the average wage per year.
3. Find the total amount of money received by second group.
4. Find the average amount per year.
5. Find the difference in total amounts earned by the two groups.
6. Assuming that each school year consisted of 200 days, what was each day spent in High School worth to the ones who took the High School course?
7. Make a chart showing two lines, one for first group's wages, one for second group's wages, for each year given in table.

LI

RENTS

The last Friday evening in February was a very, very dismal one in the Addison home. The children had come from school expecting the customary welcome and smile from Mother, but Mother had few words and no smile. When Father came home with his usual joke, no one laughed. During supper, the secret came out. Mr. Overbrook, the landlord, had called in the afternoon and announced that beginning April first, the rent would be raised to $38.00 per month. Many of us have had this experience, and we have always blamed the landlord for imposing upon us. It is well to study the facts a little and find out what a fair rental is, before we complain.

In finding a fair rental, these conditions must be considered: original cost of the property; yearly expenses—insurance, taxes, repairs, depreciation.

For Mr. Addison's home we have the following—

Original cost of property	**$2000.00**
Repairs for year	**101.48**
Taxes for year	**55.50**
Incidentals & Insurance	**18.85**

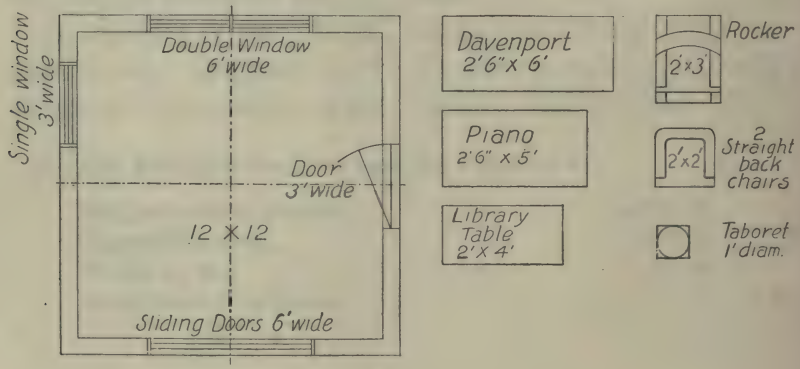
QUESTIONS

1. What were the total expenses per year? Per month?
2. Assuming depreciation to be 3% of original investment per year, what was the yearly amount? Monthly amount?
3. Allowing the owner, Mr. Overbrook, a profit of 8% on his original investment, what was amount of profit per year? Per month?
4. Add the monthly amounts of expenses, depreciation, and profit. The result gives you a fair value for monthly rental. Was the $38.00 asked unfair?
5. Suppose the yearly repairs to be 5%, insurance and incidentals 1½%, taxes 4½%, depreciation 3%, fair profit 8% of the original investment, make a table giving fair monthly rentals for the following homes—costing $1500, $1875, $2500, $3750, $5000.
6. Would you make any addition to rental price to take care of loss when house is vacant? How much?

LII

PLACING FURNITURE

"Here, Mrs. Murphy, is your piano. Where shall we put it?" Mrs. Murphy had her living room furniture all arranged to make room for the new piano, so she quickly pointed out the exact location to the men. After the piano was in place, Mrs. Murphy became a little doubtful as to whether she did want it there after all. She tried to push it over a short distance, but it was too heavy to be moved. When the other members of the family had finished supper, they were all mustered into the living-room, and put to work. The piano was moved here and then there; the library table was placed in the centre of the room, and then in a corner. After much work, a certain arrangement was decided upon as being suitable.



After it was all over, Mr. Murphy had a brilliant idea—"Why didn't we measure the pieces of furniture, and the room, and make a layout on a piece of paper? Then we could have shifted all pieces to our hearts' content without so much labor."

This plan is used by engineers in deciding upon the location of heavy articles.

QUESTIONS

1. Use a scale so that one inch on your drawing will equal two feet of the actual size of the room. Then draw the room 12′ by 12′.
2. Make the walls about one-quarter inch thick; mark in the windows as shown on the sketch.
3. On a scrap sheet of paper draw figures representing the pieces of furniture. Use the same size scale as for the room.
4. Cut out these figures, and find what is the best arrangement of the furniture, by shifting the figures to various locations.
5. After deciding upon a certain arrangement, draw the furniture to scale size in the proper locations.
6. What are your reasons for thinking your arrangement is best?
7. Make a list of the several things you had to consider.

LIII

MUSIC

It is very pleasant to sit back in a comfortable seat, and listen to a master violinist play a beautiful melody. It is much less pleasant to sit at a school desk and work fractions. Yet, the violinist would never have mastered his instrument and the music, unless he had at some time learned the arithmetic of fractions.

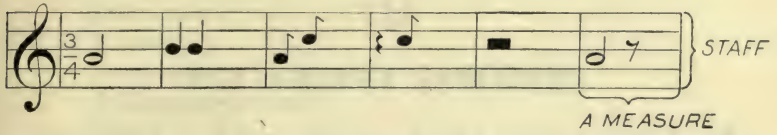
In music, the time of playing the various tones is regulated by a system of measurements called "beats." The music is written on a set of horizontal lines called a "staff." The staffs are marked into spaces by "bars" vertical lines; these spaces are called "measures." Each measure must contain notes, notes and rests, or rests, equal in value to the numbers marked at the beginning of the piece. The upper number tells how many beats are given to each measure. The lower number tells what note has a value of one beat.

The common notes are—	The common rests are—
𝅝—whole	𝄻—whole
𝅗𝅥—one half	𝄼—one half
♩—one quarter	𝄽—one quarter
♪—one eighth	𝄾—one eighth

$\frac{2}{4}$ time means that each measure must have two beats, and the one-quarter note has a value of one beat.

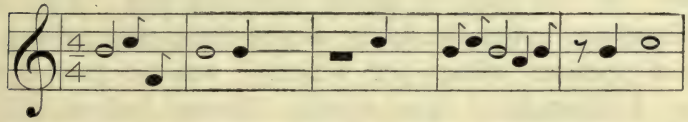
$\frac{3}{4}$ time means that each measure must have three beats, and the one-quarter note has a value of one beat.

$\frac{6}{8}$ time means that each measure must have six beats, and the one-eighth note has a value of one beat.



QUESTIONS

1. How many beats to the measure in the above?
2. What value note gets one beat?
3. Complete each measure by marking down a note of proper value.
4. Complete each measure by marking down a rest of proper value.



5. Correct each measure of above. Copy staff and mark down proper value of notes in each measure. Copy staff and mark down proper value of notes and rests in each measure.

LIV

PERSONAL EVALUATION

Big brother Tom had just returned home from New York to spend his first vacation. He was full of stories of the great city and of his own job. The younger brothers and sisters listened attentively whileTom told his Father of the tests he went through before he he was accepted for his position. He was saying, "The funniest thing they did was to give me a sheet of paper, on the top of which was marked 'Personal Evaluation.' On the body of the sheet was printed a list of various things for which I was to put down what I thought I was worth. Never before did I think so hard concerning myself. I was afraid to mark myself too low for fear they would think me no good. And I didn't want to make the marks too high, for fear they would think me conceited. But I marked what I thought was fair, and must have been about right."

The sheet of which Tom spoke contained something like the following—

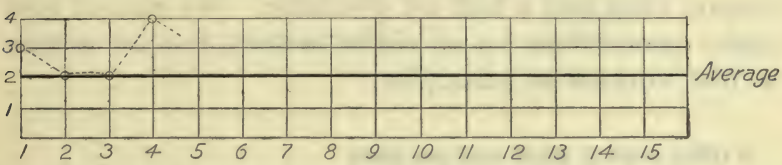
Neatness
Ambition
Carefulness
Health
Appearance
Habits
Manual Ability (ability to make things with the hands)

English
Arithmetic
Ability to follow directions
Politeness
Courtesy
Obedience
Willingness to work
Thrift

Scores to be made for each item—4 for very good, 3 for good, 2 for poor, 1 for very poor.

QUESTIONS

1. Copy the items in a column, mark your own score after each, find your total score.
2. The greatest score possible is 60. What is your per cent?
3. Find your per cent rating for each item?
4. Make a chart showing your own opinion of yourself.



5. What were your strongest points? Your weakest?

LV

PAY SYSTEMS

After leaving school and starting to work, paydays seem to be the red-letter days for all of us. After the days of toil and worry, comes the reward. And we aways want to be sure that we receive the full amount due us. As we soon learn, there is no standard method of paying—in some places we are paid by the hour, in others by the day, and in others by the pieces; in some places we receive a bonus or extra pay for certain things such as punctuality and regularity, in others, time and a half for overtime. We cannot now make calculations for an entire factory, but let us take a few workers as examples.

3 Office boys @ $8.00 each per week

9 day laborers @ $0.42 per hour—9 hours per day—6 days per week

Each laborer works 5 hours overtime per week-time and a half for overtime.

2 piece workers paid 20¢ for each fifty pieces they make

Number of pieces

#	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	1000	1250	1300	950	1325	675
2	900	1150	1250	1175	1275	850

Make calculations for one week.

QUESTIONS

1. Find the total pay for each boy. For three boys.
2. Find the total pay for each laborer. For nine laborers.
3. Find the total pay for each piece worker. For both piece workers.
4. Find the total amount of pay for all?
5. The office boys receive a 5% bonus for regularity and punctuality. The piece workers receive a 10% bonus when turning out more than 6500 piece per week. What was total amount of these bonuses.
6. Arrange your results in some systematic form.

LVI

METHODS OF TRAVEL

When Grandfather was a small boy, a trip to the nearest city and back—16 miles away—was a day's journey. In his time a trip clear across our Country—3000 miles—was a very serious undertaking. Did you ever stop to think that our Country is shrinking, that it is becoming smaller and smaller, as we invent and perfect machines that carry us faster and faster? By taking the average speeds of different modes of travel, it is possible to show by a chart the effect that greater speed has upon the size of our Country.

These speeds are average values only. In our problem, it is assumed that they could be maintained for considerable periods of time.

Travel by walking	**one mile in 20 minutes**
Travel by running	**9 miles per hour**
Travel by horse back	**6 miles in 30 minutes**
Travel by automobile	**432 miles in 12 hours**
Travel by motor-cycle	**117 miles in 3 hours**
Travel by railroad	**¾ mile per minute**
Travel by aeroplane	**1 mile in 24 seconds**

QUESTIONS

1. Find the speed of each method of travel in miles per hour,
2. Draw lines for each method, making $\frac{1}{8}''$ of each line equal to three miles per hour speed.
   Walking —
   Running ——
   Horse ———
   Auto ————
3. Taking the width of our Country at 3000 miles, find the number of days of 8 hours' travel per day, that would be required to cross by each of the modes of travel. You will then see that our Country has decreased in travel size from a 125 day journey to a $2\frac{1}{2}$ day journey.
4. Make a chart showing days required in problem three. Use your own scale.

LVII

BREAD MAKING

There is nothing quite so tasty when you are hungry as a slice of home-made bread. And good home-made bread usually is very easy to sell. Some people have done a very satisfactory business in this line, using their own kitchens as bake shops.

There is however not a great deal of profit in this work as the following problem will show.

Taking a regular recipe or formula for making bread, the materials necessary would be found to be as follows:

For making a batch of six loaves.

2 tablespoons of lard	**1 pint of milk**	**2 yeast cakes**
2 tablespoons of sugar	**4½ Qts. flour**	**2 tablespoons salt**

Measures and cost

32 tablespoons of lard to the pound @ 20¢ per pound
2 pts. of milk to the quart @ 12¢ per quart
1 pint of flour to the pound
196 pounds of flour to the barrel @ $11.50 per bbl.
Sugar and salt for 6 loaves or one batch about 1¢
Yeast cakes 3¢ apiece.

QUESTIONS

1. How many pints of flour are required for one batch of bread? How much would the flour for one batch weigh?
2. How many batches of six loaves each could be made from one barrel of flour? (Your answer does not come out even. Use the next highest whole number.)

3. Make out a table giving following items for using one barrel of flour.

Material	Amount for one batch	Amount for ? batches	Cost for ? batches

4. How many loaves would be made from one barrel of flour?
5. Selling the loaves at 15¢ each, what would be the receipts for the loaves from one barrel?
6. What would be the profit from one barrel of flour made up into bread?
7. Make out a grocery order for materials necessary for 220 loaves of bread.

LVIII

FURNISHING A ROOM

After being promoted to the position of a foreman in the packing department of Anson & Co., Mr. Scott felt that he could afford to move into a better house. But he never imagined what the results of this moving would be. It seemed that as soon as his wife and children were located comfortably in the new home, they discovered that the old furniture would have to be replaced. Now Mr. Scott was careful of his earnings and did not want to spend them faster than they were received. He agreed to set aside $200.00 for the furnishing of the living-room for a start. The other rooms would have to wait. After many evenings of catalogue searching and many days of bargain hunting, the selections of furnishings were narrowed down to this list—

	Cheap	Medium	Good
Curtains			
One double window, 4¼ yards	25¢ per yd.	50¢ per yd.	$1.25 per yd.
Overdrape, 4 yards	30¢ per yd.	60¢ per yd.	1.50 per yd.
One single window, 4¼ yards	25¢ per yd.	50¢ per yd.	1.25 per yd.
Overdrape, 3 yards	30¢ per yd.	60¢ per yd.	1.50 per yd.
Rugs			
Large, 9′ by 12′	$15.00	$ 23.50	$ 45.00
Small 2¼′ by 4½′	2.00	4.50	7.50
Library Table	11.70	24.50	47.50
Three piece set (Davenport, Rocker, Straight chair)	89.85	120.19	150.00
Reading Lamp	5.85	10.89	21.20
Pictures (each)	.89	1.65	2.25

QUESTIONS

1. The prices given represent three grades of material—cheap, medium, and good. Make your selection for each article and find the total cost.
2. Compare your total with the allowed amount of $200.00, revise your selection so that you get the best grade of goods possible under each item, and still keep within the allowance.
3. Suppose the lowest priced goods for each item had been selected, how much under the $200.00 allowance would they have been? Would this have been wise buying?
4. A furniture dealer made them an offer to supply the entire list of articles for $275.00, with two plans for payment—20% discount for cash, or full contract price, $75.00 down and the balance divided into 12 payments. Had you been Mr. Scott, which plan would you have accepted? Why?

LIX

A QUILT

Elizabeth's sewing club was sadly in need of funds for the annual outing. After some discussion at the special meeting, a scheme for making a quilt was proposed. All the members agreed that the plan was a good one, but where would they get quilting frames, what design would be used, who would buy the necessary material? As usually happens, this work was assigned to the person who proposed the plan. In this case it was Marion. Now Marion was not very good at making designs, so she coaxed and coaxed her brother Harris, until he reluctantly consented to "see what I can do." After he drew the following design, he had to help Marion figure the amount of material necessary.

The shaded portions of the design were to be made of red percale.

The light portions of the design were to be made of unbleached muslin.

The center of the quilt was made of squares—12″ by 12″—each square consisting of 8 triangular pieces, of equal size.

The border of the quilt was made of muslin.

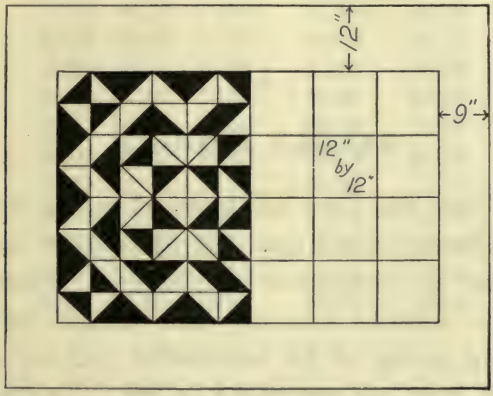
The quilt consisted of the top as explained, padding of cotton, a back of unbleached muslin.

Unbleached muslin cost 18¢ per yard—36 inches wide.

Percale cost 15¢ per yard—36 inches wide.

Cotton batting came in rolls 72 inches wide, 90″ long and cost $1.60 per roll.

Thread—3 spools @ 8¢ per spool.



Top—Percale and muslin.
Filling—Cotton Batting.
Back—Muslin.

QUESTIONS

1. How many squares 12″ by 12″ were in design?
2. What was size—length and breadth—of the quilt?
3. How many triangular pieces of the red cloth were required? Two of these pieces together made a square 6″ by 6″. How many yards of this material was required?
4. How many of the triangular pieces of unbleached muslin were needed? How many yards? How many yards of unbleached muslin were needed for the borders? How many yards for back? Total?
5. How much cotton batting was required?
6. What was the total cost of quilt?
7. The quilt was sold for $8.50. What was the profit?

LX

FAMILY BUDGET

During the war, we all learned to be thrifty and saving. Those who knew, explained to us that we should have a systematic method of saving. If we put aside a definite amount each month or each pay day, we are going to be successful. If we save only what is left over, we are going to fail. In many homes these days, parents make out lists of amounts of money that may be spent for certain things. We call this "making a budget." To understand the system, an actual budget is given below.

Yearly income $1800.00.

Estimated expenses for year.

Rent	17%
Food	27%
Clothes	18%
Pleasure, incidentals	20%
Saving	10%
Light, Heat, Water	8%

The amount left over each month was placed in an emergency fund. At the end of year this fund was added to savings.

Expenditures

	Rent	Food	Clothes	Incidentals	Light, Heat	Saving	Emergency
Jan.	$20.00	$42.50	$15.00	$20.00	$12.50	$15.00	
Feb.	20.00	44.75	12.00	18.50	12.50	15.00	
Mar.	20.00	43.50	67.50	18.00	16.50	15.00	
Apr.	28.00	40.15	10.90	15.12	12.50	15.00	
May.	28.00	38.40	50.40	15.60	12.50	15.00	
June.	28.00	35.75	40.20	35.50	16.50	15.00	
July.	28.00	36.80	18.00	21.72	10.50	15.00	
Aug.	28.00	35.70	10.10	90.50	10.50	15.00	
Sept.	28.00	38.50	30.60	20.15	14.50	15.00	
Oct.	28.00	40.25	50.25	8.50	12.50	15.00	
Nov.	28.00	41.50	8.12	10.15	12.50	15.00	
Dec.	28.00	43.60	15.06	55.20	16.50	15.00	

QUESTIONS

1. Find the total amounts spent for each item for year.
2. What was the salary received each month?
3. At the end of each month any money left over was placed in emergency fund. In case more than salary was spent during the month, the necessary money was withdrawn from the emergency fund. Make a column headed emergency, and fill in the amount of this fund for each month.
4. At the end of the year the amount of the emergency fund was added to savings account. What was the total amount of the savings account at the end of the year?
5. Find the per cents of amounts spent for each item during the year.

Item	% Allowed	% Spent
Rent.		
Food.		
Food.		
Clothes.		
Pleasure & Incidentals.		
Light, Heat, Water.		
Savings.		

LXI

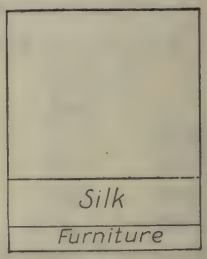
CHARTS

During National Health week, the classes of the Roxbury Continuation School were taken to see the public exhibit in the City Hall. Among the many interesting posters and charts that were on view was a large colored one. Upon this was drawn a large circle; colored sectors of the circle showed the proportion of people dying of various causes, tuberculosis, heart disease, pneumonia, Bright's disease, etc. Different colors were used on the different sectors. At a glance one could see what were the causes of the larger numbers of deaths.

The following week the teacher gave the class this problem in chart making:

Kinds of industries represented in our Continuation School.

Industry	No. of children employed
Furniture factory	25
Silk Mill	50
Box Factory	10
Shoe factory	40
Messenger	18
Stores & Miscellaneous	26
Steel Works	45
Hosiery Mill	16
Apron factory	16
Auto Repair	25
Electric Shop	10
Glove factory	9



QUESTIONS

1. Find the total number in school.
2. Draw a rectangle 4″ base and 5″ altitude. The area within the rectangle represents the total number enrolled in the school.
3. Find the height of each small rectangle (representing an industry) by using this formula—

$$\text{Height of rectangle} = \frac{5 \times \text{number employed in the industry}}{\text{TOTAL ENROLLMENT}}$$

4. Mark heights and draw rectangles. Use nearest fraction of an inch. Print neatly name of industry represented by each rectangle.
5. Can you find out how the formula was made?
6. What method could be used so that above figures could be shown by the sectors of a circle?

LXII

BENEFICIAL SOCIETY

Becoming bewildered as he was crossing Main Street, Mr. Haines stepped in front of a moving automobile. After the first few days of pain and suffering, he worried very much because of loss of his wages. But his worries would have been much more serious, had he not belonged to a Beneficial Society. Many a time he had grumbled about the monthly payments, but now he was thankful that he had continued to pay them. The society to which he belonged was formed of local men. At end of the first year, the secretary published the following statement.

Rent	$10.00 per month
Secretary	50.00 per year
Treasurer	50.00 per year
Postage and Stationery	20.00 per year
General expenses	15.00 per month

Initiation fees	$ 10.00
Sick benefits	10.00 per week
Dues	1.00 per month
Death benefits	400.00

This society was so formed that in case of a deficit at any time, the members would be assessed for a proportional share.

	New members	Died	Sickness
Jan.	70	1	20 sick for 1 week
Feb.	20	0	14 sick for 2 weeks
Mar.	10	0	8 sick for 5 weeks
Apr.	25	0	3 sick for 8 weeks
May	15	2	2 sick for 10 weeks
June	10	0	1 sick for 12 weeks
July	10	0	
Aug.	10	1	
Sept.	25	0	
Oct.	30	0	
Nov.	29	2	
Dec.	15	0	

QUESTIONS

1. What was the total amount paid for death benefits?
2. What was the total amount paid for sick benefits?
3. What was the total amount of other expenses?
4. Find the amount of all expenses and payments of benefits.
5. How many members were admitted during the year? How much did they pay for initiation fees?
6. What was the amount of monthly dues received by the treasurer?
7. What was the financial standing of the society at the end of the year?
8. Mr. Haines had paid dues for four years, up to the time of his accident. He was sick for eight weeks. Did he make a good investment?

LXIII

INTEREST TABLES

During a week's experience as bank messenger, Maurice Lambert learned that two things were considered especially important—speed and accuracy. He learned that the bank employees were using charts, tables, adding machines, posting machines; everything that made it possible to transact business in the speediest manner and with least error.

Instead of counting the number of days between two dates, Maurice noted that they used printed tables by which the number of days could be found in a few seconds. Instead of working out the amount of interest for a certain number of days, he noticed that they used large books in which were found amounts of interest for certain sums for various periods of time.

The assistant cashier was very friendly, and from time to time, would explain certain calculations to Maurice. At one of these occasions he opened the large interest book and showed him the following figures—

Principal	143 Days Amounts of Interest 3%	4%
$10,000	$119.17	$158.89
9,000	107.25	143.00
8,000	95.33	127.11
7,000	83.42	111.22
6,000	71.50	95.33
5,000	59.58	79.44
4,000	47.67	63.56
3,000	35.75	47.67
2,000	23.83	31.78
1,000	11.92	15.89

Example

Find interest on $9654 for 143 days at 4%.

According to our school method we would find 4% of $9654, divide by 360 and multiply by 143.

According to bank method—

Int. on $9000		143.00
Int. on	600 ($\frac{1}{10}$ of 6000)	9.53
Int. on	50 ($\frac{1}{100}$ of 5000)	.79
Int. on	4 ($\frac{1}{1000}$ of 4000)	.06
		153.38

QUESTIONS

1. Find the interest on $9500.00 for 143 days at 3% by both methods. Time yourself and decide which method you consider speedier and more accurate.
2. Maurice's father was thinking of giving a note for $1225 for 143 days, at 6%. What would have been the amount of money received by him—use above scale? (In accepting notes, banks usually deduct the amount of interest from the face value of the note, you receive the remainder.)
3. Make a table of your own similar to above for 125 days, at 3%, 5%, and 6%.

LXIV

SHOE REPAIR

"How much did he charge this time? One dollar and seventy-five cents! I declare, it keeps your Father working all the time to keep you children in shoes." Clifford had often heard his Mother complain of the cost of having shoes repaired. Usually, he did not pay much attention. But this time he remembered having seen an advertisement which had a glaring headline. "Mend Your Own Shoes." He searched around till he found the advertisement. Keeping it secret from the family, he ordered a cobbler's outfit. When it arrived he showed it to the astonished family and said, "now bring on your old shoes." The first job was a little queer looking, but he soon improved his workmanship. He kept close account for a year, and this is what he discovered—

He bought:

A complete cobbler's outfit, express included	**$4.85**
6 pairs men's size soles	**2.50**
6 pairs women's size soles	**1.73**
12 pairs boy's size soles	**3.96**
2 pairs half heels rubber size 10	**1.12**

QUESTIONS

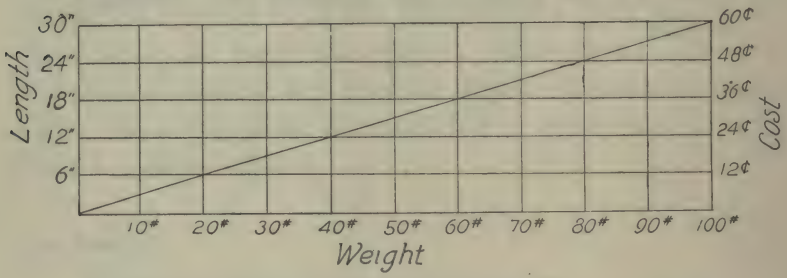
1. He tried his own shoes first, putting on one pair boy's size soles. The shoemakers charge would have been $1.50. How much did he save on this job?
2. Next he soled three pairs of children's shoes, using boy's size soles. What did he save on these jobs? Shoemaker charged $1.40 for each pair.
3. After becoming more skilled, he soled and heeled his father's shoes using two pairs men's size soles, two pairs rubber heels. The shoemaker's charge would have been $5.50. What did he save here?
4. Being a fairly skilled workman now, he soled two pairs of shoes for his mother and one for his sister, using women's size soles. The shoemaker's charge would have been $5.15 for the three pairs. What was the saving?
5. At the end of the year what would have been the shoe repair bill if all jobs had been taken to the shoemaker?
6. What was cost of all materials he used?
7. Did he save enough by his work to pay for all the material and equipment he bought?
8. What was the value of the materials and equipment remaining?

LXV

CURVES

Samuel felt very important on his first trip. He had been given an ice route to take care of, the regular driver being ill. He listened very carefully to the various instructions that Mr. Allen gave him concerning cutting, weighing, and charging. A peculiar looking card was tacked up near the rear of the wagon. From this he could easily find out what lengths of pieces to cut for different weights, and what prices to charge. Of course, after he cut the piece, he weighed it to be sure that it was correct.

This is a copy of the card—



For a 20 pound piece, he read up the 20 pound line till he reached the diagonal line or curve, then he read straight across to the left outside vertical line and read the length—6″, he then read straight across to the right and read the cost 12¢.

QUESTIONS

1. Find the lengths and costs of pieces for 25 pounds, 65 pounds, 70 pounds, 75 pounds, 90 pounds.
2. Several people asked him for these pieces—10¢ piece, 15¢ piece, 25¢ piece, 40¢ piece. What were lengths and weights of these pieces?
3. A standard one-hundred pound block of ice measures about 7 inches by 14 inches by 30 inches. The lengths of pieces for certain weights are calculated from this formula—

$$\text{Length in inches} = \frac{\text{weight} \times 1728}{7 \times 14 \times 57.5}$$

See if the chart lengths are correct for 25 pounds, 50 pounds, 75 pounds?

4. Mary thought she was cheated one day when the iceman charged her for an 80 pound piece of ice. She did not have any scales, so she measured the piece and calculated its weight from this formula—

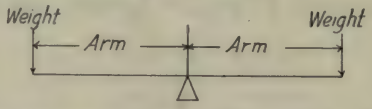
$$\text{Weight in pounds} = \frac{57.5 \times \text{length} \times \text{width} \times \text{thickness}}{1728}$$

The piece measured 7″ by 14″ by 20″. Was she cheated?

LXVI

LEVERS

On nearly every play ground we see the old familiar "see-saw." Every one has had a ride on a see-saw at some time. And even grown-up people—if they think no one is watching—enjoy a ride very much. Even very little children know how to work it; they know that the heavier person must sit closer to the place upon which the see-saw rests. And this thing that the children know, engineers use in planning great machines. It is called the "theory of levers." Although you have done the thing many times without figures, let us apply the theory or rule to the see-saw and get some interesting results.



The supporting piece is called the "fulcrum." The distances from the weights to the fulcrum are called "arms." Sometimes instead of sitting on your end of the board, you have pressed down on it; this pressure is called a "force."

Rule: Multiply the given weight and its arm, divide by the other given weight or arm. The result gives the missing arm or weight. The weights are usually given in pounds and the length of "arms" in feet.

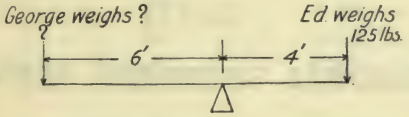
Harry weighs 80 lbs. Anna weighs 100 lbs.

Example

How far from the fulcrum must Harry sit? $\frac{100 \times 5}{80} = 6\frac{1}{4}'$

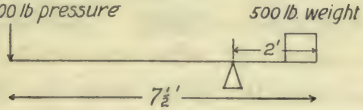
QUESTIONS

1. How much does George weigh?



2. Would this see-saw balance? On which side would you have to push to balance it? Where would you put the 80 pound boy?

3. Would this stick be long enough to raise this weight? How long a stick would you need?



LXVII

PERSONAL SHOPPING SERVICE

For several weeks, Clara had been out of work. And she was becoming rather tired of her former job of "turning gloves." One day she sat down with the intention of finding out what she was best fitted for, and what job or position would be suitable for any special ability she might have. As she thought and thought, she remembered that her people had always complimented her on her careful and wise buying. Here was the special ability. Thinking further, the complaint of a neighbor, who was unable to go shopping, came into her mind. Here was the job. Next day she made a careful canvass of the neighbors and explained her plan. "I shall call at your house each morning to get your shopping list and instructions. If the purchases as received are suitable, you shall pay me ten cents plus 1½% commission on the value of the purchases. If the purchase is unsatisfactory, no charge will be made." The plan worked well from the start. Soon Cousin Joe had to be called in every evening to help keep the accounts straight. A weeks business was as follows—

First week

Day	Number of orders	Value of orders	Unsatisfactory purchases
Monday	15	$ 9.50	2($1.37)
Tuesday	12	10.25	0
Wednesday	18	18.75	1($0.85)
Thursday	17	13.50	0
Friday	14	10.15	1($1.15)
Saturday	25	17.85	2($0.98)

QUESTIONS

1. Find the amount due her for Monday's purchases? Find the amount of her earnings returned because of unsatisfactory purchases? Find the net amount received for Monday?
2. In the like manner for the other days, find the amount due, amount returned, net amount received?
3. Find the total earnings for the week?
4. Her only expense was street car fare, four trips per day, at two trips for 15 cents. What were the net profits per day? Per week?
5. At the end of ten weeks, she had become so successful in her buying, that one of the large department stores offered her $85.00 per month to accept a position as assistant to the one in charge of "Personal Shopping Service." Before accepting, she and Joe studied the accounts. They learned that the business was steadily increasing 5% each week. She could still take care of the business after a 75% increase. What were her weekly profits at end of the tenth week? What would be her profits when business increased 75%? What would you have advised her to do?

LXVIII

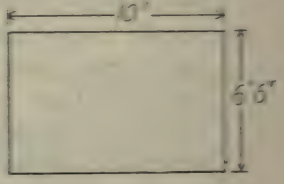
AIR MEASUREMENTS

In all working places where the air is liable to become impure because of dust, gases, or smoke, fresh air must be forced in by means of fans or blowers. In order to be sure that sufficient fresh air is being secured, the quantities of air are measured by inspectors, and the qualities of the air are determined by chemists.

John had coaxed his Father, who was a mine inspector to take him through the mine workings and explain how he measured the air. His Father showed him a small instrument called an anemometer which showed how fast the air current was traveling. He then explained that the size and area of the passageway was found, after which he calculated the amount of air by this formula—

$$Q = A \times V$$

Quanity of air in cubic feet per minute.
A area of passageway in square feet.
V velocity of air in feet per minute.



QUESTIONS

1. What was the area of the passageway in square feet?
2. The velocity of the air was 15 yards in 5 seconds, how many feet was that per minute?
3. What was the quantity of air in cubic feet per minute which was going through the passageway?

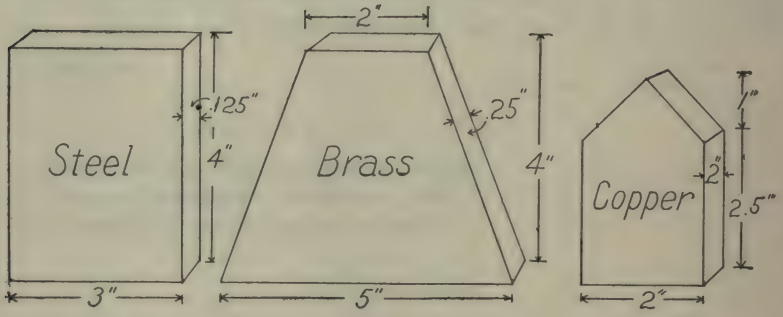
4. A chemist took a sample of the air and found it to contain—Oxygen 19.5%—Nitrogen 80%—Carbon Dioxide 0.5%. How many cubic feet of each passed through per minute?
5. Under certain conditions, one hundred cubic feet of the air weighed about 7 pounds. What was the weight in tons (2000 pounds) of air going through the mine in 24 hours?

LXIX

SHIPPING WEIGHTS

The chief engineer of the Adams Novelty Company, always prepared a list of weights of new styles of stamped pieces. At first when Elizabeth became his stenographer, she merely typed these lists. Later as she became more accustomed to the work, she was often called upon to check these weights.

One of these lists called for the following:



Style #1 **Style #2** **Style #3**

Steel weighs	**.283 pounds per cubic inch.**
Brass weighs	**.31 pounds per cubic inch.**
Copper weighs	**.319 pounds per cubic inch.**

QUESTIONS

1. Weight is found by multiplying area times thickness times weight per cubic inch. Find the weight of one piece style #1.
2. Find the weight of one piece style #2.
3. Find the weight of one piece style #3.
4. Style #1 was packed in three size lots—1000—2500—5000; what was the shipping weight for each size lot?
5. Style #2 was packed in three size lots—750—1250—2500; what was the shipping weight for each size lot?
6. Style #3 was packed in three size lots—1250—5000—7500; what was the shipping weight for each size lot?
7. What would be the total shipping weight for an order of—
   Style #1—5000?
   Style #2—1250?
   Style #3—7500?

LXX

CONTRACTS

Instead of becoming cross and sending the children out of the room when he was working out bids for new contracts, Mr. Andrews always took pleasure in explaining to them just how he did the work. Both Claude and Irene found that their ability to solve problems in arithmetic was strengthened very much by this practice. Mr. Andrews was a cement contractor. Very often he was given the blue-prints or drawings of proposed constructions, and was asked to submit his bid on very short notice. Now he did not always have time to work out the cost of every item—material, labor and "overhead"—so he had worked out a form like this by which he was guided when making "hurry-up" estimates.

Material cost	22%
Labor cost	46%
"Overhead"	10%
Profit	15%
Extras	7%

In estimating the amount of the bid he calculated the cost of materials from the latest price lists Assuming this amount to equal 22% of his total bid, he was able to submit it in a very short time.

Three of his jobs were as follows—

Job #1. Estimated cost of material $2420.
Actual costs—material $2940, labor $6000, overhead $1500, extras $655.

Job #2. Estimated cost of material $3916.
Actual costs—material $3750, labor $8050, overhead $1650, extras, $1450.

Job #3. Estimated cost of material $330.
Actual costs—material $525, labor $850, overhead $215, extras $175.

QUESTIONS

1. If $2420 represented 22% of the bid, what would 1% be? 100%?
2. What did job #1 actually cost him?
3. What was his actual profit on job #1? His estimated profit?
4. What was the amount of bid on job #2?
5. What was the actual cost?
6. What was the actual profit? His estimated profit?
7. Find the same for job #3?
8. What was the actual profit on the three jobs? The estimated profit?
9. Taking the three jobs as a whole, what were the actual percents spent for the various items?

LXXI

PAINT

Very often when Mr. Hayes, of the Adams Paint and Varnish Co., was in a hurry he gave Bertha, his stenographer, the task of checking his calculations on estimates for quantities of paint required. The first time she was given this work, it was very difficult. But she thoroughly learned a few rules, after which it was very easy.

These are the rules:

1. One gallon of paint covers about 300 square feet—first coat and 400 square feet—second coat.

2. To find out how much paint is required for a house, multiply the distance around the house by the average height.

3. Allow an additional 15% of the quantity thus found for body, for trimming-cornice, porch pillars, etc.

4. The quantity for porches is found by finding the area in square feet and dividing it by the number of square feet one gallon will cover.

One of the lists handed to her was—

	Length & Width	Average height	Front porch	Rear porch	
House #1.....	30′ by 40′	20′	6′ by 20′	6′ by 8′	2 coats
House #2.....	25′ by 35′	18′	6′ by 12′	4′ by 6′	2 coats
House #3.....	20′ by 40′	22′	6′ by 6′	4′ by 4′	1 coat
House #4.....	22′ by 38′	24′	8′ by 12′	5′ by 12′	2 coats
House #5.....	38′ by 38′	14′	7′ by 12′	7′ by 8′	2 coats

QUESTIONS

1. What is the distance around house #1? Find the approximate square feet by multiplying by the average height? How many gallons of paint are required for the first coat? For the second coat?
2. Allowing 15% extra for trimming, how many gallons are required for body and trimming?
3. How many square feet in the two porches? How much paint is required?
4. Work out the quantities for each of the other houses?

LXXII

ELECTRICITY

The agent had called at the house several times before he managed to sell the electric iron. After using it once Mrs. Nelson was highly pleased with her purchase. All the family was much interested in its operation. Her daughter, because of the ease of ironing; her son, because it gave him a chance to display some of his electrical knowledge. He made the statement one day after coming home from school, that he could calculate what it cost to operate the iron. Mrs. Nelson called her daughter saying, "You will be using all kinds of household electrical equipment some day. You'd better learn this too."

Joseph explained it this way—"On all pieces of electrical equipment you will find certain information stating the number of volts, and the number of amperes required. Now, if you multiply the "volts" by the "amperes," you will get "watts." If you multiply these "watts" by the number of hours you use the piece of equipment, you get "watt-hours." Electric current is sold by the "kilowatt hours." "Kilo" means one thousand. So, when you divide the "watt-hours" by 1,000 and multiply by cost per "kilowatt hour," you have the cost of operation."

The formula or rule would be—Cost $= \frac{\text{V} \times \text{A} \times \text{hours used}}{1{,}000} \times$ **costs per KWH.**

V = **volts**
A = **amperes**
KWH = **kilowatt hours.**

QUESTIONS

1. The iron was marked 110 to 125 volts; 4.7 to 5.4 amperes. Using the average, how many watts would this be?
2. The iron was used for 2.5 hours, how many watt-hours?
3. Dividing the watt-hours by 1000, how many kilowatt hours were used?
4. The cost of the current was 10¢ per kilowatt hour (K.W.H.). What was the cost for this amount? What was the cost per hour for operating the iron?
5. Electric light bulbs usually have the watts marked on them. Then we multiply these watts by the hours the light is used to get K.W.H. Find cost of three 75-watt lights—each burning 60 hours per month—cost of current 10¢ per K.W.H. Add about 10% for waste current. What would be the cost per hour for burning one light?

LXXIII

"WANT AD"

"I believe some mistake has been made in this ad bill from the Clarion people. We never ordered $86.00 worth of advertising last week. "Kathryn, take this duplicate order and this rate card and see if you can find the error." Kathryn, as stenographer for Mr. Hayes of the Aetna Tire Shop, was called upon to do many things. So, she was not at all disturbed over her latest assignment. Copies of the duplicate order and rate card follow. Kathryn discovered the mistake.

Rates

Three cents per word each day—1 to 8 days.
Minimum charge 36 cents.
Classified Display $2.00 per inch—1 or 2 times.
Classified Display $1.75 per inch—3 times.

The Bill

	Ad #1—29 words—7 days	$ 6.09
	Ad 2—48 words—6 days	2.88
	Ad 3 7 words—5 days	1.80
	Ad 4—55 words—6 days	9.90
Display		
	Ad #1—2½ inches—2 times	10.00
	Ad 2—5¼ inches—3 times	9.19
	Ad 3—3½ inches—1 time	7.00
	Ad 4—3¾ inches—6 times	23.14
	Ad 5—1¾ inches—4 times	16.57
		86.57

QUESTIONS

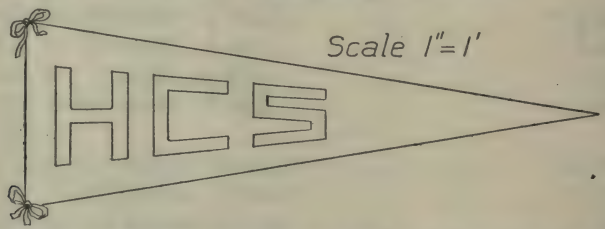
1. Find the cost of each ad according to the given rate?
2. Find the total amount of the bill?
3. Where was the mistake made?
4. One advertising page of the newspaper contained—72 inch display ads. 88 inch classified ads, these ads averaged ½ inch space, contained about 17 words each. What was the value of this page to publisher, if words cost three cents each, display ads $1.75 per inch?

LXXIV

PENNANTS

The Continuation School football team was going to play the High School Freshman. Three weeks remained for preparation of yells, songs and cheering. The working boys and girls were going to show the Freshmen that they could defeat their team, yell as loud, sing as well, and display just as good school spirit as any Freshman. At the last minute, it was discovered that there were no Continuation School pennants. Everyone turned to the work with a will. The girls selected the colors—blue pennant with red letters. The boys in the drawing class drew the design. Both boys and girls in the Arithmetic class worked out the amounts of materials required and the cost. The boys cut out the materials to proper size and shape. The girls sewed on the letters and ribbons.

The design worked out by the boys is given below—



The material used was felt. It was sold in 72″ widths @ $3.00 per yard. Two bows of ribbon were sewed on each pennant. Each bow required 9″ of ribbon. Ribbon cost 15¢ per yard.

They decided to make 44 penants.

QUESTIONS

1. On a piece of paper draw a rectangle representing one yard of the felt—72″ wide. Use a scale 1″ equals 1′.
2. On this rectangle mark the pennant outline—12″ by 36″. Use the arrangement which gives least waste.
3. How many yards of the blue felt would be required for the 44 pennants? What would be the cost?
4. How many yards of ribbon would be required for the 44 pennants? What would be the cost?
5. The H letters measured 6″ by 4½″; the C letters measured 5″ by 4½″; the S letters measured 4″ by 4½″. How much red felt was needed? What was the cost?
6. What was the total cost—blue felt? Red felt? Ribbon?
7. What was the cost per pennant?

LXXV

HEAT

The class in Physics had been learning many wonderful facts. They had learned that the velocity of light and the velocity of sound had been measured—that light travels 186,000 miles per second, and that sound travels 1100 feet per second. They learned that heat could be measured in two ways—the quality or intensity and the quantity or amount. They were all familiar with the instrument used in measuring the intensity—the thermometer. They had never thought of measuring the amount of heat. Yet, chemists, coal operators, and gas men, all measure the amount of heat that various fuels will give off when burning.

The most economical fuel would be the one that gave the most heat for the least money.

Let us make a few comparisons of the various kinds of fuel.

The unit of heat measurement is called a B.T.U.—British Thermal Unit.

One B.T.U. is the amount of heat required to raise the temperature of one pound of water, one degree (Fahrenheit Thermometer).

Gas Natural	**1,100,000 B.T.U. per 1000 cu. ft.**
	@ $ 1.00 per 1000 cu. ft.
Gas artificial	**322,000 B.T.U. per 1000 cu. ft.**
	@ 1.50 per 1000 cu. ft.
Coal anthracite	**14,900 B.T.U. per pound**
	@ 10.00 per ton (2000 lbs. per ton)
#1 Coal bituminous	**13,500 B.T.U. per pound**
	@ 6.00 per ton (2000 lbs. per ton)

#2 Coal bituminous..... 14,500 B.T.U. per pound
@ 7.00 per ton (2000 lbs. per ton)
Wood..... 7,000 B.T.U. per pound
@ 4.20 per cord (3000 lbs. per cord)

Suppose we had $4.20 to spend for fuel, and wished to find which fuels would give us the greatest numbers of B.T.U's for the money.

QUESTIONS

1. How many thousand cu. ft. of natural gas could we buy? How many B.T.U's.?
2. How many thousand cu. ft. of artificial gas could we buy? How many B.T.U's.?
3. How many pounds of coal (anthracite) could we buy? How many B.T.U's.?
4. How many pounds of coal (#1 bituminous) could we buy? How many B.T.U's.?
5. How many pounds of wood could we buy? How many B.T.U's.?
6. How many pounds of coal (#2 bituminous) could we buy? How many B.T.U's.?
7. Arrange the fuels in order, highest value B.T.U. first, etc.

LXXVI

SICKNESS

"Health is Wealth." Mr. Jackson was resting comfortably at home after two weeks of hospital life. As he was unable to go to work for another two weeks, he was occupying some of his spare time by finding the cost of his sickness. He had always been thrifty and saving with his money. The Doctor had told him that he had not been thrifty and saving with his health. To get the best results, thrift is necessary with both. The final accounts as submitted to Mrs. Jackson for her inspection were as follows—

Savings in bank at time of sickness	$859.67
Amount of savings each week	5.50
Weekly wages	32.50

Time spent in hospital, two weeks.

Hospital expenses—

Room (including meals)	$ 25.50 per week
Three x-ray examinations	35.00
Special nurse two nights	5.00 per night
Surgeon's charges for operation	200.00
Medicine, gauze, etc	5.75 per week
Street car fare (members of family) 56 trips)	.08 per trip
Flowers and fruit	3.75

Sick benefits from Beneficial Society—$15.50 for first week.
10.00 per week thereafter.

QUESTIONS

1. What was the amount of the hospital expenses?
2. What was the amount of wages lost during the idle period?
3. What was the amount received from Beneficial Society?
4. What was left in the savings fund after all bills had been paid? Remember household expenses ran along just as usual.
5. What would have been the amount of savings had no sickness occurred?
6. What was the total of money lost because of the sickness? How many weeks of saving at $5.50 per week would be necessary to make up this loss?

LXXVII

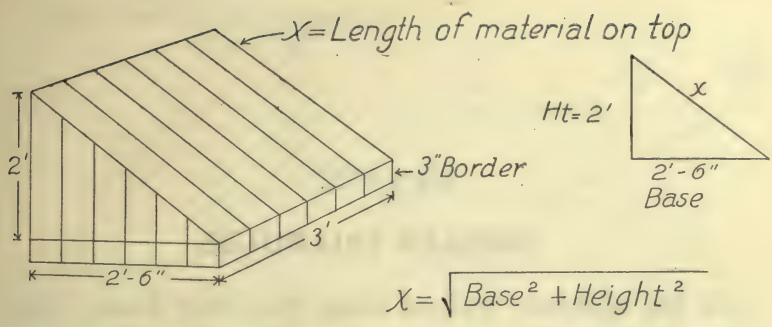
SQUARE ROOT

"I don't see why we must learn square root. Nobody ever uses it any how." Floyd was being particularly nice to his sister Mabel this morning, and was walking to school with her. But he couldn't resist the temptation to enter into an argument. When she made the above statement about square root, he thought very hard for a minute or two then answered, "Why, engineers and surveyors and draftsmen and college students use square root every day." "Very true" said Mabel, "but we are not engineers or surveyors or draftsmen or college students. When would square root be of any use to us?" Floyd said "Well we'll ask our teacher." When the teacher was consulted she said, "I used square root at home yesterday. We wanted to have awnings for our windows. They were rather expensive at the stores. Since father is a mechanic, he consented to make the frames if we would make the covers. In calculating the length of material required, we had to use square root."

The length of material for the top would be equal to the hypothenuse of a right triangle.

The material measured 36″ in width.

Length of the cloth runs as shown by the lines on the sketch.



QUESTIONS

1. What length of material would be needed for side pieces? Allow three inches extra length on each piece for hem.
2. What length of material was required for the border? The border was 3″ deep, allow 3″ extra for seam and hem.
3. Find the length of top piece needed, by formula. Add 6″ for hems.
4. What was the total length of cloth required?

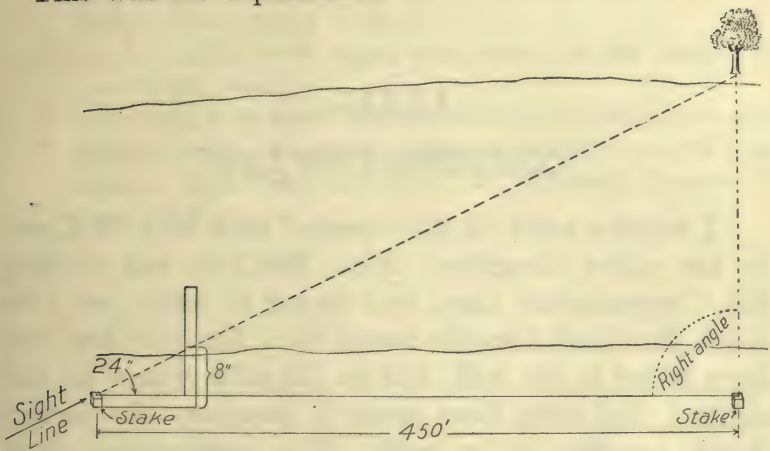
5 Could the problem have been solved without using square root? How?

LXXVIII

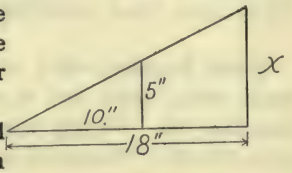
SIMILAR TRIANGLES

As the children walked along the river bank, they noticed a man going through a number of strange movements. At the widest part of the river they saw him drive a large stake into the bank. He next fastened one end of a tape measure to the top of the stake. After walking along the bank, he halted when he had measured a certain distance. At this point, he drove another stake in the ground. He then lay flat on the ground and sighted along a carpenters square, he had carried with him. After making a mark on the square, he took out a note book and pencil and made some calculations. By this time the children had caught up with him and couldn't resist the temptation to ask what he was doing. His reply startled them—"Measuring the width of the river." They thought he was joking, but as he seemed serious, they asked "How?"

This was his explanation—



In similar triangles, we can find one part of a triangle providing we know one part of it, and two similar parts of another similar triangle.



Ex. The vertical height of the small triangle is just one-half of its base, then the vertical height of the large triangle will be one-half of its base.

QUESTIONS

1. What was the width of the river as the man measured it?
2. Suppose the short length had been 11″, what would have been the width of the river? 5″? 12″?
3. The same method may be used in finding the height of trees, chimneys, or buildings. Find height of these objects—
   Tree—measurement taken 40′ from tree. Base of square 24″, line of sight cuts blade at 11.5″. Don't forget to add height of eye from ground.
   Chimney—measurement taken 50′ from chimney. Base of square 12″, line of sight cuts blade at 18″.

LXXIX

COMPENSATION LAW

"I wonder what all this means" said Mrs. McCann to her eldest daughter. Mrs. McCann was reading the Compensation Law, and trying to learn just how much the death benefits would be. Mr. McCann had been killed in the mill, and in the state where he had worked, the state laws made it necessary for certain death benefits to be paid. The section that Mrs. McCann was reading was something like this—

Death Benefits—40% of weekly wages to widow, 5% additional for each child, total not to exceed 60%. Payments close when child becomes 16. Weekly wages based on not less than $10.00 nor more than $20.00. Payments not to continue beyond 300 weeks, except in cases where child is under 16, when one child receives 15%, 10% additional for each additional child, total not to exceed 50%.

Mr. McCann's weekly wages had been $30.00.

The family consisted of Mrs. McCann; Henry 15 years old; Nellie 13 years old; Harry 10 years old; Elizabeth 6 years old.

QUESTIONS

1. What per cent would Mrs. McCann receive for herself? How many dollars per week?
2. What per cent would be received for the four children? How many dollars per week?
3. What was the total benefit received by family for first year? (52 weeks per year).

4. After the first year, would the benefits be more or less per week? How much? Why?
5. At the end of three years, what would be the amount of benefits per week?
6. At the end of six years, what would the benefits be per week?
7. What would be the total amount of benefits received from time of Mr. McCanns death till Elizabeth became 16 years old?

LXXX

COMMERCIAL EXCHANGE

Both children had helped their Mother very much since their Father had died. The Mother baked fine home made bread, pies and cookies, and the children delivered and sold them. Usually they found a ready market for these products. One day Florence took along with her a set of doilies which she had made in her spare time. The set was easily sold. Lawrence, encouraged, tried selling a serving tray that he had made. It also was easily sold. The success of these attempts set the family to thinking. "Why not turn the front room into a little store and sell home made articles. Other people in the neighborhood would be glad to put articles they had made in the store." The idea was carried out. They called the store "The Commercial Exchange," and devoted their entire time to running it.

It was managed in this way—Anyone could bring articles for sale. Each person put his or her own price on the article. The "Exchange" did not buy the goods, but took care of them, advertised, sold and delivered them. No article would be kept more than three weeks. For this service the "Exchange" charged 20% commission. Only cash purchases were accepted.

Expenses

Phone—$2.50 per month.
Advertising—$8.00 per week.
Equipment—shelves and show cases (second hand)—$48.50.

One weeks sales amounted to the following—

80 loaves of bread	$ .18 per loaf
8 sets of doilies	6.75 per set
28 pies	.22 per pie
60 dozen cookies	.23 per doz.
12 glasses of preserves	.53 per glass
3 serving trays	2.85 a piece
20 pounds of candy	.44 a pound
20 pounds of salted peanuts	.52 a pound
12 hand towels	.48 a piece
2 prs. of hand painted salt & pepper shakers	2.48 a pair

QUESTIONS

1. The two children received $2.00 each per week for their help. What were the total expenses of running the "Exchange" for one week? The equipment was to be paid for in 12 weekly installments.
2. What was the amount of sales for the week as given?
3. What was the amount of commission at 20%?
4. What was the net profit per week?
5. Basing your calculations on 52 weeks per year, and the above week's sales as average, what would be years net profit? Remember the equipment was paid for at the end of 12 weeks.

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